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VOLUME XXVIII JANUARY, NINETEEN HUNDRED FIVE NUMBER ONE

THE MUNICIPAL CONDUIT SYSTEM OF ERIE, PA.

By Benjamin E. Briggs, City Engineer.

The following article has been prepared in response to several inquiries on the subject.

The interest manifested by many public spirted citizens throughout the country in the question of municipal ownership cannot be centered on a more desirable proposition than a public conduit system. The cost of such an improvement is small, when compared with the street car, water or lighting plant; it is quickly constructed, simple to operate, and is beneficial, both from a financial and civic art point of view.

As far as the writer's knowledge goes, the city of Erie constructed the first strictly municipal conduit system in this country.

The preliminary steps for this improvement were taken in the spring of 1897, in a very broad ordinance by the City Council, "authorizing the construction of an electrical conduit in State-st., from Second-st. to Eighteenth-st., consisting of sixteen ducts, more or less, etc." It was the intention of the promoters that some sort of an underground passageway should be provided for the wires and cables of all the companies operating pole lines in the central portion of the city. After a legal battle of some twelve months with a citizen who disputed the rights of the city to construct such a system, and compel the removal of overhead wires (which would force the companies to occupy the conduit), the Supreme Court confirmed the opinion of the local court, which was, in effect, that under its police powers, the city was justified in the act.

Work was started under the supervision of the writer, in 1898, and the trunk line, of 6,047 feet, was completed the same year. From year to year the system has been extended, under the electrical department of the city government, until the city now owns and operates 19,151 lineal feet of conduit, of from two to thirty ducts, making the total available space 197,738 lineal feet of duct, together with the necessary available service boxes, and fifty-eight distribution poles, all of which has cost the city $21,993.50

The cost of maintenance, aside from the services of the electrical department, has been approximately the mere nominal sum of $22 per annum.

The rate of rental was fixed at 5 cents per lineal foot of duct, which includes free use of the poles. At present the various companies are using rented space amounting to 49,948 feet of duct, which produces an annual revenue of $2,497.40 and the city fire and police departments are occupying 11,449 feet of duct, leaving for future use, 61,397 feet of duct.

The system was constructed with the main line in State-st., which is the principal thoroughfare, with the greatest number of ducts nearest the central stations of the two telephone companies, which are fortunately located on opposite sides of Ninth-st. near State-st. By an examination of the accompanying Plate A, the reader will probably obtain a more comprehensive idea of the conditions than by a wordy description. The plate also shows the line of the conduit by dotted lines, manholes by circles, and poles by a dot over a dash.

The average depth of trench was fixed in the contract at five feet, as the water connections were supposed to lie at about that depth, and the gas connections at a depth of two and one-half feet, apparently leaving a clear right-of-way for the conduit of two feet. However, pipes were found at all depths, from one to seven feet, and it became necessary in each block to open the trench from one manhole to the next, in order to fix a grade that would conflict with the smallest possible number of pipes, and also provide for draining the ducts.

In the first contract on this work the contractor was required to furnish all labor and material, and construct a conduit of vitrified tile three-inch ducts, nested in numbers ranging from four to thirty, laid in cement mortar and protected on the four sides with concrete.

The following prices were paid:

11 cents per foot of duct in nests of 4 to 6 ducts.

10.4 cents per foot of duct in nests of 8 to 10 ducts.

9.6 cents per foot of duct in nests of 12 to 18 ducts.

7.8 cents per foot of duct in nests of 20 or more ducts.

25 cents per foot for 3-inch wrought iron pipe, laid.

$300.00 for each manhole. Cast iron covers were furnished by the city.

These prices included the replacing of stone pavements, curb stone, brick and stone side walks. Other kinds of sidewalks and pavements were replaced under a separate contract.

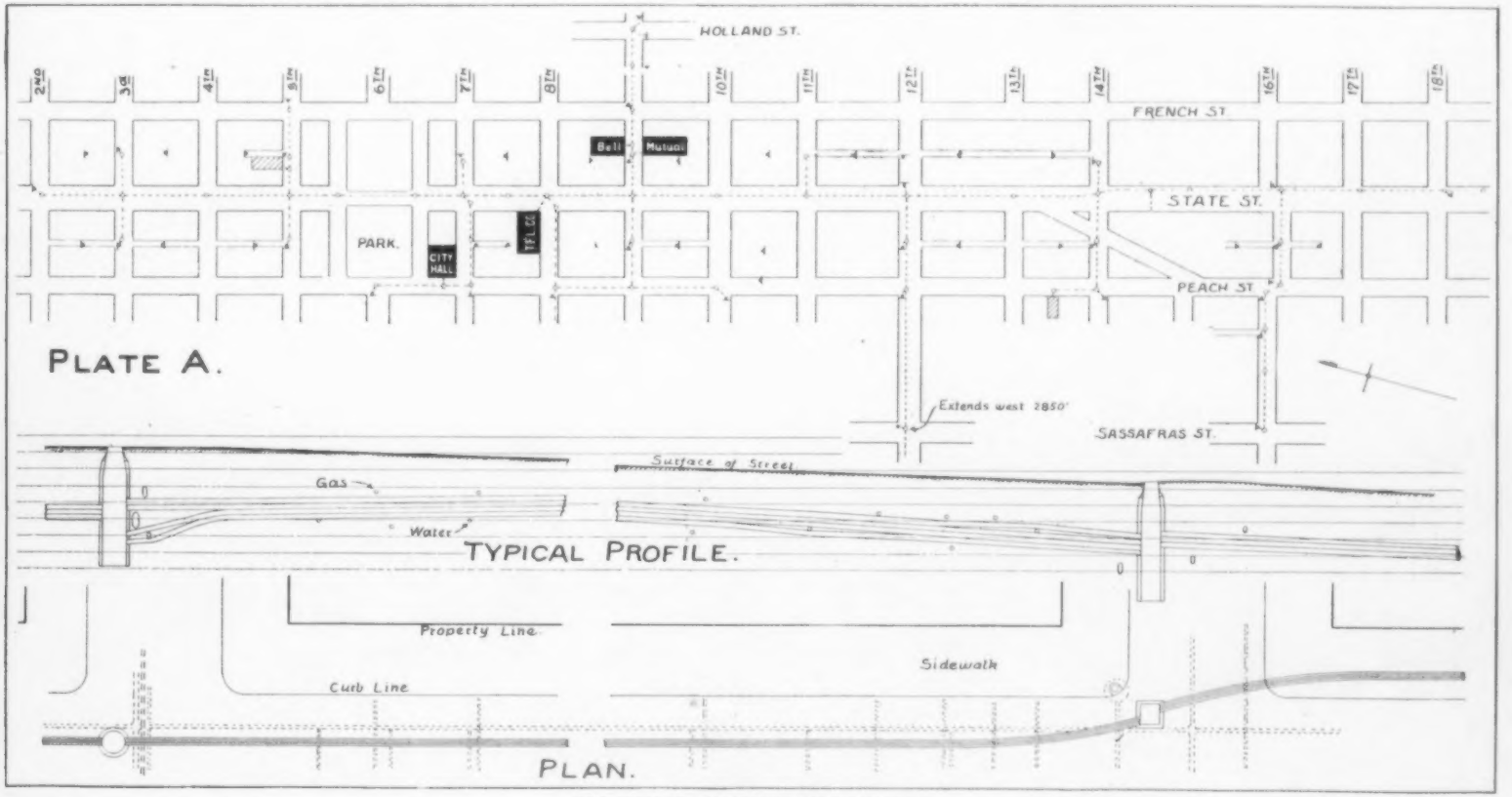
The tile ducts used in the main line of this work, of which a section is shown in Plate B, are made in regular lengths of eighteen inches, and short lengths of from two to twelve inches. The ducts were laid by a mason, in the same manner that he would build a brick wall; a wooden "mandrel" slightly less in diameter than the duct, with a rubber disk screwed to the rear end, was placed in each line of ducts when the work was started, and was drawn along the line as the work progressed, so that the forward end of the "mandrel" was at all times within easy reach from the end of the last duct laid. This "mandrel" serves the purpose of keeping the ducts in line until the mortar sets and the rubber disk, which is of the same diameter as the inside of the duct, scrapes off any mortar that may have gotten in through an open joint.

The size and shape of manholes were made to fit the conditions and limited space frequently found between the numerous pipes encountered below the surface of the street. They were made either circular or oblong in shape, with eight inch walls, or rectangular with twelve inch walls. Where the manholes were built in sand or gravel no provision was necessary for drainage, except to cover the bottom with two inches of clean gravel, but where any hard material was encountered a "P" trap of sewer pipe was placed in the bottom of the manhole and connected with the sewer.

In order to avoid cutting the pavement in certain blocks the conduit was constructed under the sidewalk. In order to shift from the driveway to the sidewalk the line was curved toward the curb, to a radius of one hundred feet as it approached the cross street, where a rectangular manhole was constructed, which the line entered near one corner, leaving it from the diagonally opposite corner, and by a reverse curve swinging in back of and parallel with the curb. No difficulty has been experienced, so far, in drawing two-inch diameter cables through these curved ducts. Where basements or vaults had been built to the curb the lines of ducts were extended through them with three inch wrought iron pipe securely bolted together, and spaced to line up with and match the tile ducts. Where the space from wall to wall was such that it required a greater length of pipe than twelve feet, they were supported by iron bolts from the flag stone overhead.

In the original plans provision was made for ventilation, to guard against explosions from gas that accumulates in the manholes. The plan was to lay a three-inch iron pipe from near the bottom of the manhole to the curb, that end being protected by a return bend extending above the sidewalk; a similar pipe was to be laid from near the top of the manhole to the nearest pole, to which it would be attached, extending up the pole about twenty-five feet and acting as a stack. Before this plan was carried into effect the conduit work was transferred to the electrical department, and work was soon suspended for want of funds, and the ventilating was not accomplished. As a result of no ventilation there have been several explosions in the higher portion of the city, which, fortunately, have caused no greater damage than to wreck the tops of several manholes and the surrounding pavement. To guard against further explosions, a small electric fan is now operated in a manhole for a few minutes just before the workmen enter it with fire.

The method adopted for distributing telephone service wires was to erect a sixty-foot pole in or near the center of each regular block of three hundred feet square, or two poles in each long block. From these distribution poles the service wires radiate as the spokes of a wheel, to the various buildings containing telephones. These poles are placed in alleys, or on private property when there is no alley in the block. These distribution poles carry an overhead cable from the nearest pole connected with the con-



MUNICIPAL CONDUIT AT ERIE, PA.
Map and Section.

duit. This method has proven entirely satisfactory.

Recent extensions to the system have been laid with the multiple duct, which is made in lengths of three feet. This pattern is very desirable from the fact that it can be laid without the aid of a high priced mason, but in certain cases the single duct is indispensable, as will be seen by an examination of Plate A-Typical Profile. To avoid an expensive depth of trench the lines of ducts had to be separated to pass some of the numerous pipes. The spaces between the lines were filled with concrete. It might be stated right here, that, in the opinion of the writer, it is not undesirable to have a water pipe pass through a manhole, from the fact that bonding cables to water mains is one of the methods used to guard against electrolysis, from which there is great danger to all underground metal construction.

By a comparison of the cost of this system with that constructed by private corporations it will be seen that a municipality builds very much the cheaper. This may be accounted for by the fact that private concerns cannot be given the same freedom in the streets and sidewalks that the municipality will assume, nor have they the same power to cause pipes and other obstructions that interfere with the work to be removed.

In this city, with rival electric light companies, two telephone and two telegraph companies owning and operating pole lines, it was found impossible to clear the streets of the forest of poles, or even to reduce the number by attempting to induce the companies to use a union pole, i. e., a pole to be used by all the companies. This condition resulted in the city declaring its intention to construct a conduit for their common use. However, the present system was not designed to accommodate electric light and power wires, on account of the action of councils, after hearing the arguments of a representative of one of the telephone companies that the induction from the cables carrying the wires of high voltage for electric light and power service would greatly injure, if not wholly destroy, the telephone service. This argument, however, is contradicted by actual practice in many places.

This conduit has been in operation for four years, and the companies using it are all well pleased with the service, and are anxious to have the city extend the system over the district covered by all their main lines. The extensions will be made as rapidly as the necessary funds are provided. The revenue derived from the rentals is a very desirable item, and pays a return to the city of over 11 per cent on the amount invested. The removal of many high poles and a mass of wires from our streets has been a great improvement. The fire hazard has been lessened, and the insurance rates should be decreased enough to enable the citizens to recover whatever increase the construction of the conduit may have occasioned in the rate of taxation

TENSILE STRENGTH OF HIGH CALCIUM AND MAGNESIUM LIME.

By George V. Rhines, C. E., Toledo, O.

It is a most peculiar fact, but it is true, that lime, the most important and the most extensively employed of all building materials, really receives the least consideration at the hands of both architects and builders. The rapid development of the cement industry in the United States has to a certain extent educated the architect so that every up-to-date office is equipped with testing apparatus for determining the tensile strength of cements used on buildinggs in which the architect is interested. It seems logical that it would occur to these men that the quality of the lime used in their work is of sufficient importance to be given much more attention than is the case at present.

Even if the architect is indifferent, it seems strange that the contractor, who has his reputation at stake, should fail to look into the matter more carefully, and it is beyond comprehension why the owner, who is the most interested of all, should be willing to accept without a murmur, any lime the brick contractor sees fit to supply. In all probability it is more a matter of ignorance than any intention to slight this important detail, that permits the use of weak or inferior lime, for there is no reason why good lime should be much, if any, higher in price in any locality east of the Mississippi river.

There are two principal forms of lime—one made from practically pure limestone known as high calcium lime, and the other made from dolomite known as

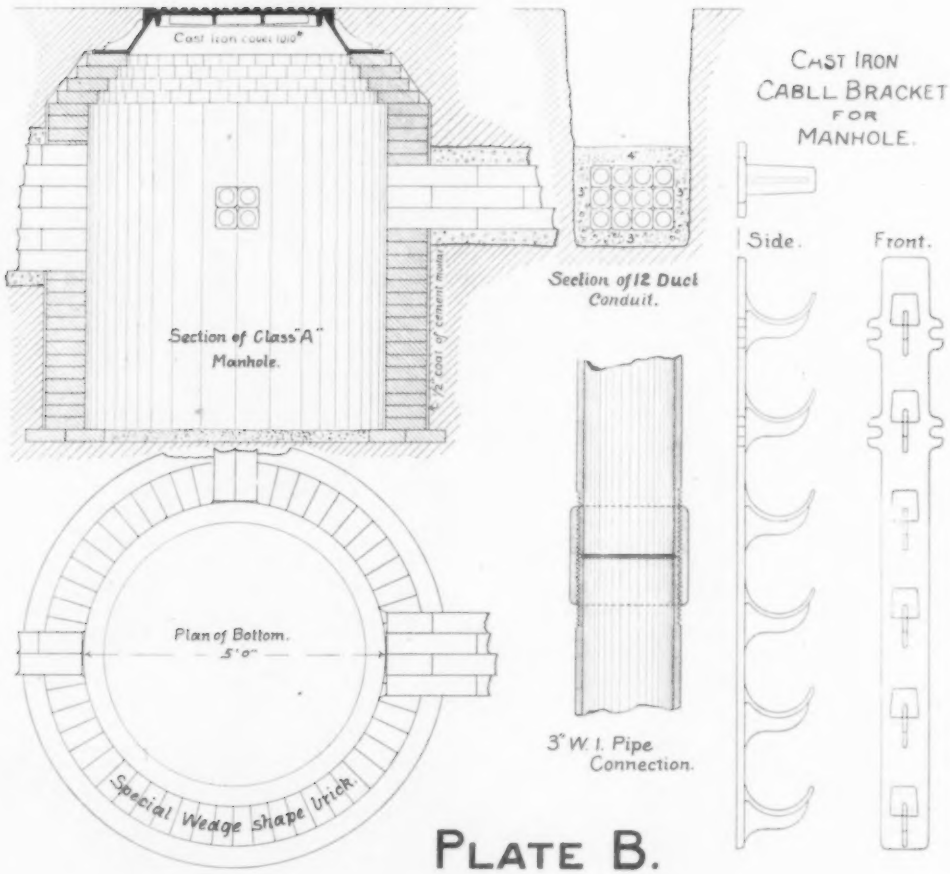


PLATE B.

MUNICIPAL CONDUIT AT ERIE, PA.
Manhole and Details.

magnesium lime. The latter contains about 40 per cent oxide of magnesia which does not swell and give out heat to any appreciable extent when slaked, but which has strong cementing properties. This presence of magnesia is responsible for the preference of the mortar mixer or slaker for high calcium lime, as the calcium oxide will slake almost immediately on the addition of water in any kind of weather, and no skill whatever is required other than to see that the water is added often enough to prevent burning.

When the dolomite lime is used, it is necessary to add the water very gradually, and after the first supply is added, the mass should be agitated to prevent "drowning" until the heat is generated by the chemical action of hydration. It is then necessary, at the proper time, to add more water in such quantities as to allow this hydration to continue, but not enough to check the chemical action, which would cause lumps or "chestnuts" as they are called, to remain in the mortar. Furthermore, large stones or core are sometimes present in the dolomite limes, due to the fact that a much greater degree of heat is required to burn calcium carbonate than magnesium carbonate, and it is necessary to take out these stones before adding sand in the mixing box.

The calcium oxide swells considerably when hydrated, while the magnesium oxide does not. This gives the calcium lime a somewhat greater bulk, and as sand is invariably mixed by eye, as much being added as the mixer thinks sufficient to bring the mortar to proper richness, the result is a larger yield of mortar when the hot lime is used. The hot lime swells more than the dolomitic lime, but it just as surely shrinks more when drying and leaves large cracks unless the brick work follows it down. Furthermore, the excessive shrinkage destroys the bond between the brick and the mortar, which is a most important factor in the strength of the wall.

Examination of walls of buildings constructed in cities where hot lime is used exclusively indicate that there is scarcely any adhesion between the mortar and the brick after the wall has stood a few years, and the mortar can be crumbled off with one's fingers. On the other hand the comparatively slight shrinkage in dolomite lime together with the cementing qualities of magnesium oxide present are the means of causing mortar made from this lime to adhere so strongly to brick that it is impossible to separate the two without breaking the brick.

The comparison is particularly marked in northern Ohio, where the two limes are quarried and burned within a few miles of each other, and the accuracy of the above statement can readily be determined.

In order to compare the strength of the two limes, complete tests covering a period of one year have just been completed by Mr. George S. Mills, architect, of Toledo, O. The results are surprising to those not familiar with the manufacture of lime, and there can be no misunderstanding of the figures which clearly indicate the difference between the two grades. No one need deceive himself as tests can be made with very little trouble or expense and the results will invariably show that the dolomite lime is nearly twice as strong as the hot lime.

The results of the tests are given below.

SCHEDULE OF TESTS FOR COMPARATIVE TENSILE STRENGTH OF DOLOMITE AND HIGH CALCIUM LIME.

All figures are pounds per square inch.

DOLOMITE LIME.

Two parts sand to 1 part slaked lime by weight.

	4 weeks.	8 weeks.	3 months.	4 months.	6 months.	1 year, Aug. 4.
	Broke placing in machine.	28	42	58	90	95
		25	45	45	75	85
		35	32	43	77	80
		29	34	55	90	96
		20	40	57	83	103
		36	30	48	.....	98
Av...		28⅜	37⅛	51	83	92⅜

HIGH CALCIUM LIME.

Two parts sand to 1 part slaked lime by weight.

	4 weeks.	8 weeks.	3 months.	4 months.	6 months.	1 year, May 27.
	32	31	40	46	57	48
	27	36	38	51	50	50
	30	39	36	24	45	42
	22	41	43	40	56	38
	32	36	.....	47	57	45
	41	.....	.....	26	40	.....
Av...	30⅜	36⅔	39¼	39	50⅜	44⅔

The analysis of the dolomite limestone tested is as follows:

Calcium carbonate	.....54.20
Magnesium carbonate	.....45.06
Silica	..... 0.45
Iron and alumina	..... 0.275

The lime was burned from pure dolo-

mite and although it came from several different localities the analysis does not vary more than 1 or 2 per cent in any case.

The analysis of the high calcium limestone is very closely as follows:

Calcium carbonate	86.22
Magnesium carbonate	9.27

Not only do the tests show the dolomite lime to be stronger after three months, but the difference constantly increases and after six or seven months the strength of the hot lime begins to decrease, while the dolomite lime shows a constantly increasing strength.

As a matter of fact, the calcium oxide in the hot lime is completely transformed into its hydrate, while in the dolomite lime the calcium oxide is completely hydrated, but 40 per cent of its composition, magnesium oxide, remains as an oxide and in all probability eventually changes to a carbonate directly from the oxide.

In an article on hydrated lime in Engineering News June 9, 1904, Mr. S. Y. Brigham makes the following statement:

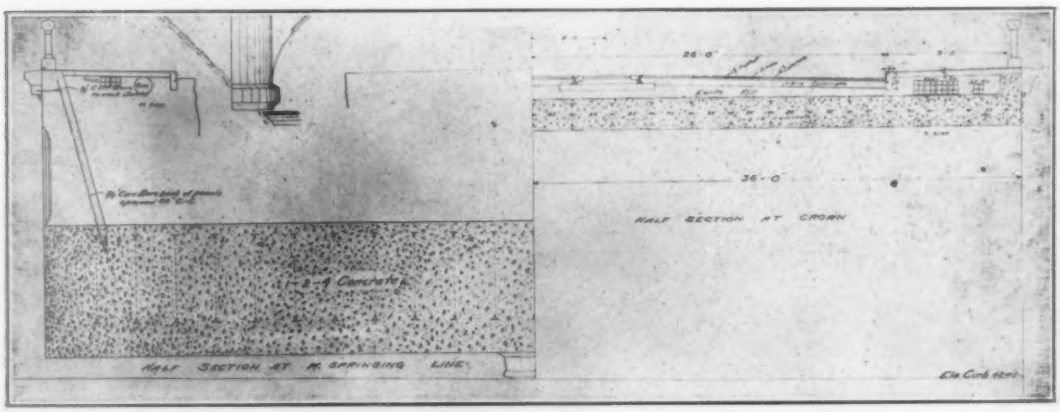
"As a matter of fact the high calcium lime will take more water and is more bulky when slaked than the magnesia lime, and the mason by his crude method of mixing will invariably put in more sand with the calcium lime than with the magnesia. It is for this reason in this section that the masons and contractors prefer the calcium lime, for the actual tests will show that in laying a certain number of brick, less lime is required with the calcium than with the magnesia lime. If they would look into the matter a little further, they would easily discover that mortar from calcium lime has about one-half the tensile strength of that from magnesia lime and if it has been prepared with the proper amount of sand to give equal tensile strength, the magnesia will have laid about 60 per cent more brick than the calcium lime.

"This can also be stated in the following manner: If each mortar were prepared with the proper percentage of sand so that the same amount of lime would lay an equal amount of brick, the tensile strength of the magnesia lime mortar would be largely in excess of the tensile strength of the calcium lime mortar."

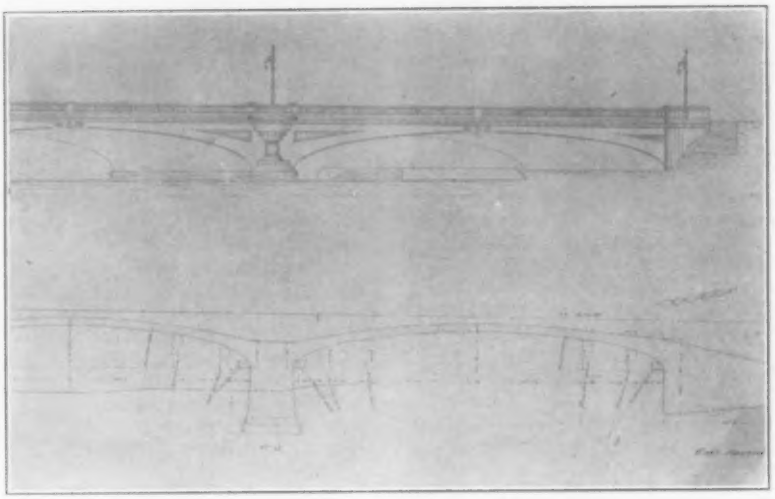
A SKEW-ARCH OF CONCRETE STEEL.

The accompanying drawings show some details of the plans of a concrete-steel bridge over St. Joseph River at Jefferson street in South Bend, Ind. The bridge consists of four skew arches and has a total length of 482 feet between abutments and a width of 72 feet between spandrel walls. The skew is at an angle of 60 degrees and there is a grade of 1.3 per cent in the roadway. The design was made by A. J. Hammond, City Engineer of South Bend.

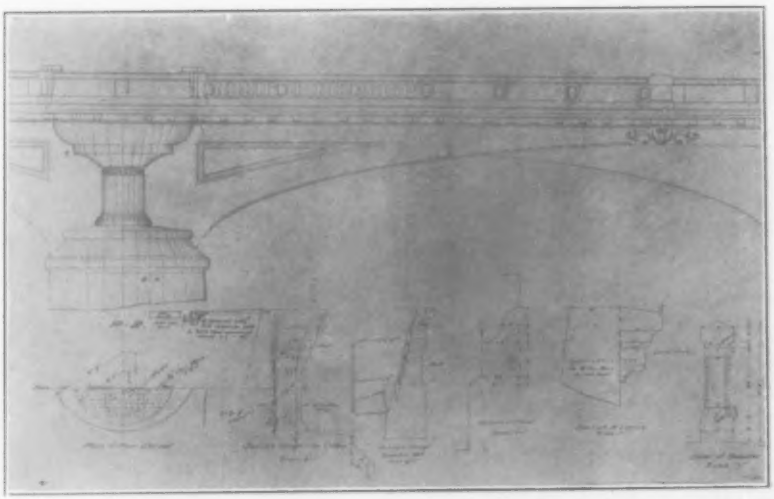
The first of the accompanying drawings shows the east abutment and pier, the first arch and part of the second. The second drawing shows the details of the ornamental parts, pier corbel, spandrel



CONCRETE STEEL ARCH AT SOUTH BEND, IND.
Cross sections of arch at crown and springing.



MELAN ARCH BRIDGE AT SOUTH BEND, IND.
Elevation and longitudinal section.



MELAN ARCH BRIDGE AT SOUTH BEND, IND.
Pier and sections of ornamental features.

wall, panel, cornice and baluster, in section and in place on the bridge. The third drawing shows cross sections of half the width of the bridge at the crown and at the springing line.

The old bridge on the site is moved to one side and set on pile bents to be used as a temporary bridge during the construction of the new one, for foot, vehicle and street car traffic. After the new bridge is completed the old bridge will be taken down and erected on a new site at Springbrook Park.

The bridge is designed to carry the structure itself computed at 150 pounds per cubic foot for concrete, 120 pounds for fill and 150 pounds for pavement, a live load for roadway and sidewalks of 150 pounds

MELAN ARCH BRIDGE AT MISHAWAKA, IND.

a square foot and a concentrated moving load of a 40-ton electric car. The modulus of elasticity of the concrete is assumed as 1,500,000 pounds and that of the steel at 30,000,000 pounds. The maximum stress permissible is fixed at 500 pounds per square inch for concrete in compression, 50 pounds in tension and 75 pounds in shear. The steel ribs under a stress not exceeding 18,000 pounds per square inch must be capable of taking the entire bending moment without aid from the concrete and have flange areas of not less than one one-hundred-and-fiftieth part of the total arch at crown. The ribs are built of four angles connected by lattice bars and they are placed at equal distances apart as shown on the third of the accompanying drawing. Corrugated steel reinforcing bars are also used in the piers, abutments, arches and spandrel walls.

Expansion joints are provided for in the spandrel walls. All concrete surfaces exposed to view or to the weather will have a mortar (not grout) face of a minimum thickness of one inch. The top of arches, piers and abutments and back of all walls will be coated with mortar thick enough to make a reasonably smooth surface. The mortar facing must in every case be built up with the concrete and no plane of demarkation of any plastering is permitted. This mortar is of one part Portland cement and 2½ parts sand, measured loose. The top surface of arches, piers and abutments and inner surfaces of spandrel walls, before the fill is put in, will be given a heavy coat of pure Portland cement grout, followed after setting of the cement by a coating of coal tar pitch not less than ⅛-inch thick.

The coping, balustrades and parapets on wing walls are made of the same concrete used in the arches. All exposed faces are of mortar, at least ¾-inch thick, including every member of the balustrade, this mortar being of the proportions above stated. The copings and the bases and tops of the balustrades are molded in suitable forms in sections five feet long, or such as can be readily handled. This work is done elsewhere than on the bridge. Each baluster is molded in one piece in a metal or plaster form. The posts over the piers are molded in place. The parapet walls over the wing walls may be made in place or molded

elsewhere in sections. All concrete blocks are kept moist or in water after the first twenty-four hours for at least ten days and are protected from the direct rays of the sun. The balusters are doweled to the base and top of the balustrade with cement mortar dowels.

The details of design of steel work and methods of construction are similar to those described in Municipal Engineering, vol. xxvii, p. 83, to which reference may be made for such as are not here described.

The accompanying photograph shows a concrete-street bridge at Cedar street, Mishawaka, Ind., constructed on plans made by Mr. Hammond and under his supervision and completed in August, 1904. This bridge is of three spans, each 110 feet and is 40 feet wide, 28-foot roadway and a 6-foot sidewalk on each side. The face of the concrete is the so-called spaded face afterward washed with a cement grout. The contractor very carefully watched the spading of the material to make the face so that it was very satisfactory before the grouting was applied.

We are indebted to Mr. A. J. Hammond for the photographs, drawings, specifications and data from which the points of special interest in the designs have been gathered for this article.

MILWAUKEE STREETS, BRIDGE AND BUILDINGS.

The city of Milwaukee, Wis., was somewhat slow in beginning the permanent improvement of its streets but has been making up for lost time during the past ten years. Formerly it was satisfied with round cedar blocks or cheap macadam streets, with granite blocks for the principal business streets, especially in the wholesale district, and there were but few exceptions to these rules.

The first asphalt street was laid in 1893, was but 395 feet long and 50 feet wide and cost $2.93 a square yard. To the end of 1903 115 contracts had been completed, amounting to twenty miles of pavement. The price per square yard has usually varied between the limits of $1.95 and $2.30 with a few streets above the latter figure. The width of pavement between curbs is usually from 30 to 50 feet, three streets being 60 feet, part of two 56, one 52 and one part 52 and part 61 feet wide. Concrete foundation is used, 6 or 7 inches in thickness, with one or two streets each 4 and 5 inches in thickness. The asphalt is laid with a binder course ½ to 1 inch in thickness and a top 1½ to 2 inches in thickness. The period of guaranty is 5 years on each street, and 75 contracts are still under guaranty. All the pavements were laid with Trinidad Lake asphalt, but the last State Legislature passed a law forbidding cities to specify by name any brand of asphalt to be used for paving or repairing. The specifications have therefore been changed and now state the amount of bitumen to be contained in the pavement, and thus presumably admit any asphalt, including asphalt rock, which contains the required percentage.

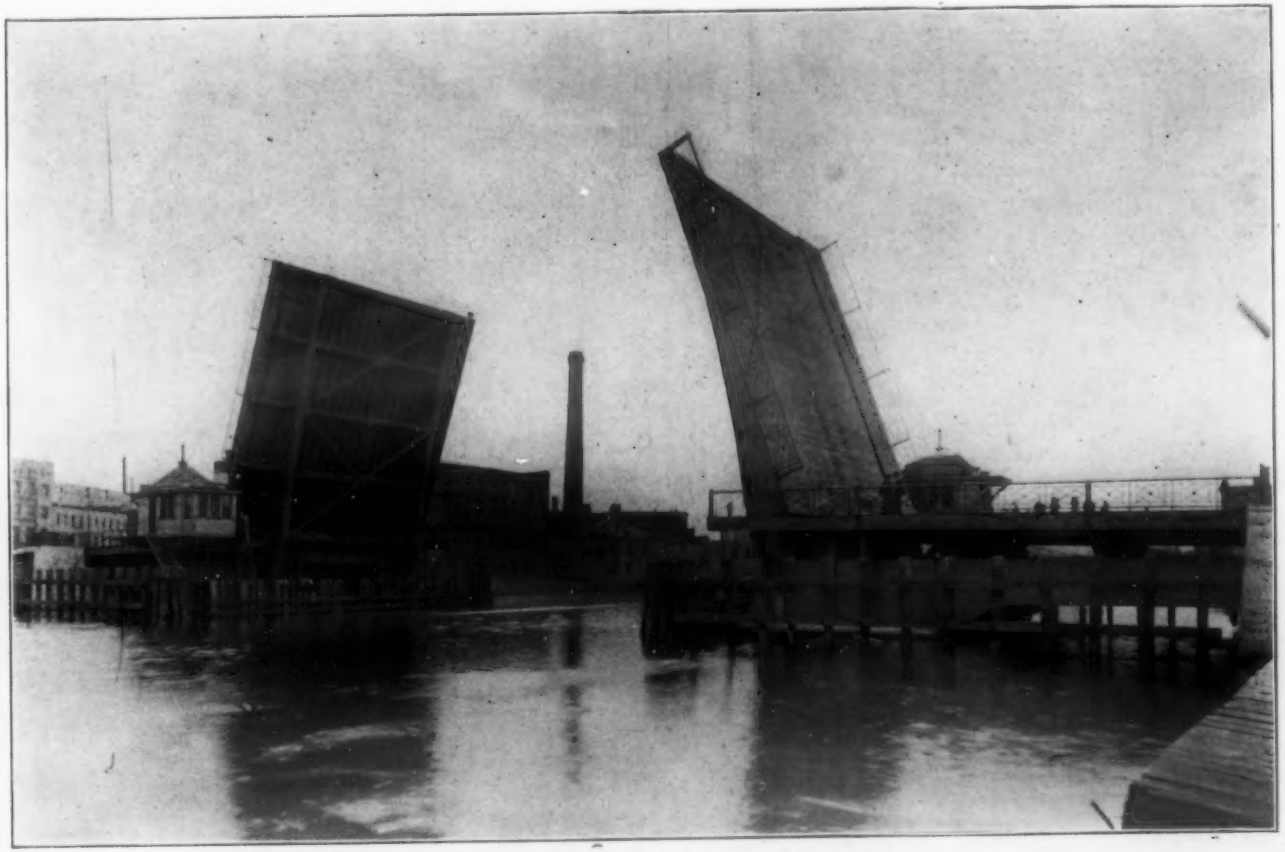
Stone paving has been laid occasionally since 1893. Eleven contracts aggregating 6,583 linear feet of street, were let for granite, and three streets, 1,548 feet, for Menomonee Falls limestone. These pavements were all laid on 6-inch concrete foundation and eight of them under five years' guaranty.

The granite pavements cost from $2.34 to $3.21 a square yard. The limestone pavement laid in 1897 cost $1.75 and that laid in 1902 cost $2.235 a square yard. Width between curbs is 45 to 56.75 feet.

Brick pavements have been laid occasionally since 1895 and in increased amount in the last year or two. Six and seven-inch concrete foundations are used and tar filler. Blocks from Ohio, Indiana and Illinois have been used with a few of the smaller ordinary brick size. The 39 contracts aggregate 6.9 miles of streets and alleys, the street pavements being from 40 to 50 feet wide, with one 60 feet and part of one 34 feet, and the alleys being 14 and 20 feet wide. The cost per square yard was from $1.40 to $2.55, the cost prior to 1900 being less than $2 a square yard in every instance, from $1.90 to $2.22 in 1900 and above $2 in every contract let since 1900.

The roadway on the Sixteenth-st. viaduct was paved with creosoted southern yellow pine blocks in 1903 and is so satisfactory that its further use is recommended by the City Engineer.

There are 528.7 miles of streets in the city, of which 20.3 miles are asphalt, 9 miles are stone, most of it laid before 1893, 6.9 miles are brick and 41.1 miles are wooden block, nearly all round cedar laid prior to 1893. There are in all 77.8 miles of paved streets, 244.9 miles of gravel and limestone macadam streets and 74.4 miles



I. BROADWAY BRIDGE, MILWAUKEE, WIS. OPEN.

of paved alleys. This leaves 206 miles of unimproved streets.

Twenty-seven miles of pavements on streets and alleys were laid in 1903 at a cost of $397,625, of which the city paid about one-third.

The city sprinkles the streets at a cost of $57,931, but as no data as to length and width of streets sprinkled are given this figure is of little value. In about half the wards of the city the cost of sprinkling was assessed on the abutting property to the amount of $31,151. In the remaining wards the city paid the bill, about $26,000.

Two new bridges were completed during 1903, and are shown on accompanying photographs.

The Broadway bridge, shown in plates I, II and III, was contracted for in December, 1901, to be completed in August, 1902, but was not opened to traffic until June, 1903, on account of delays in getting steel. It is a deck bridge 248 feet long, with 36-foot roadway and two 10-foot sidewalks. There are two fixed spans aggregating 148 feet length and a draw span having a clear channel opening of 100 feet. This span is a bascule bridge with fixed trunnion. The contractor was paid $125,375 for the bridge construction, and inspection and tests cost $3,604.66. Wire, conduit and other electrical work and a few miscellaneous items cost $607.88, making the total cost of the bridge $129,587.53.

Plate I gives a full view of the bridge, closed; plate II shows it with the draw open, and plate III shows the pavement and sidewalks.

Contract for the Muskego-ave. bridge over North Menomonee Canal, shown in plate IV, was let in May, 1903, and the bridge was finished during the summer of 1904. This bridge is 157 feet 9 inches long and consists of two stationary parts and two equal parts of a lift span which has a clear channel opening 70 feet wide in the general direction of the river and 81 feet 6 inches in the line of the bridge. The contract price for the bridge was $93,800. The foundation for the piers is of piles driven to hard ground and cut off 20 feet below the datum line. The concrete foundations for the piers begin two feet below the tops of the piles. The pits in the piers left to receive the counterbalancing parts of the girders when the bridge is open are lined with steel ¾ of an inch thick to prevent leakage and the formation of ice in them.

Plate IV shows the roadway and sidewalks, the girders of the drawspan making divisions between street and walks.

The city of Milwaukee has several public baths which are very poplar and are excellent examples of a valuable, though free, public service at low cost to the city. The west side natatorium cost $6,333.35 for salaries and maintenance in 1903. Of this amount $1,979 was spent in fuel, $329 for gas, and $152 for soap, brushes, etc. The number of attendants varied from 15,735 in February to 58,880 in August, and aggregated 400,340 for the year. The cost per person was, therefore, 1.58 cents. The south side natatorium cost $5,430.39 for salaries and maintenance, and had an attendance of 232,947, making the cost per person 2.33 cents. The Whittaker swimming school, operated during July, August and September, cost $1,759.91 to maintain, $1,000 being for rent. With 71,400 attendants the cost was 2.46 cents per person for this addition to the summer bathing facilities.

A new natatorium was constructed during 1903, being opened to the public Jan. 2, 1904.

This building is thoroughly modern and includes a brick swimming pool 77 feet 10 inches by 27 feet 10 inches, twenty shower and six tub baths, 38 dressing-rooms, an office, four living rooms for the superintendent, and necessary toilet accommodations in the portion devoted to the natatorium; and in the library section, a library room, storage accommodations and toilet facilities. The building cost $51,262.92, of which sum about $2,500 was expended for architects and inspectors. The ornamental character of the building is well shown in the accompany illustration, plate V.

Two new police stations were contracted for in June, 1903, and completed in 1904. They are built on the same plans and their contract prices were $23,387 for No. 4 and $22,320 for No. 5. Plate VI shows one of them.

The Board of Public Works also constructs school buildings. During 1903 an eighteen-room building was completed at a cost of $68,821; one of fourteen rooms and an assembly hall for $58,106; another of the same size for $60,638, with two others under way.

11. BROADWAY BRIDGE, MILWAUKEE WIS. CLOSED.

SIDEWALK CONSTRUCTION FOR SMALL CITIES.

By J. C. Herring, City Engineer, Jefferson City, Mo.

The width of the sidewalk should be governed by the locality and use to which it is subjected. For a sparsely settled residence neighborhood it may be from four to six feet. If used as a promenade or located on a popular thoroughfare it may be eight or more feet. On a business street it should be twelve feet or more.

In the residence portions where the width of the street will admit, a parkway should be laid out on each side.

For a sixty foot street the roadway can usually be made thirty feet; this will leave fifteen feet on each side for walks and parking. Of this a space of three feet may be left next to the property line, then six feet for walk, which leaves six feet between walk and curb for parking.

These spaces may be parked in various ways. In our western cities where trees are more of a rarity than in the east, from one to three rows of shade trees are usually set in the parkways. Trees should not be set less than three feet from either the walk or the curb as the roots in their growth will destroy them, especially granitoid or stone.

Trees may be set about fifteen feet apart, those on the street side of the walk alternating with those on the property side.

The lateral slope of the sidewalk and parkway may be from one-fourth to one-half inch to the foot depending on the nature of the walk and the improvement of the parkway.

At the street corners, where the walks intersect at different grades, the lateral grade of each walk must be modified so that the plane of each walk will conform at the point of intersection, with the longitudinal grade of the other walk. To do this the plane of both walks must be warped and the warping should be commenced far enough back to avoid the appearance of being too abrupt. As a rule the side of the walk toward the curb is changed little, if any, the warping being effected by raising or lowering the walk next to the property line. The correct warping in requires judgment and experience.

Sidewalks may be constructed of cinders, gravel, boards, plank, brick, stone, cement tile or concrete.

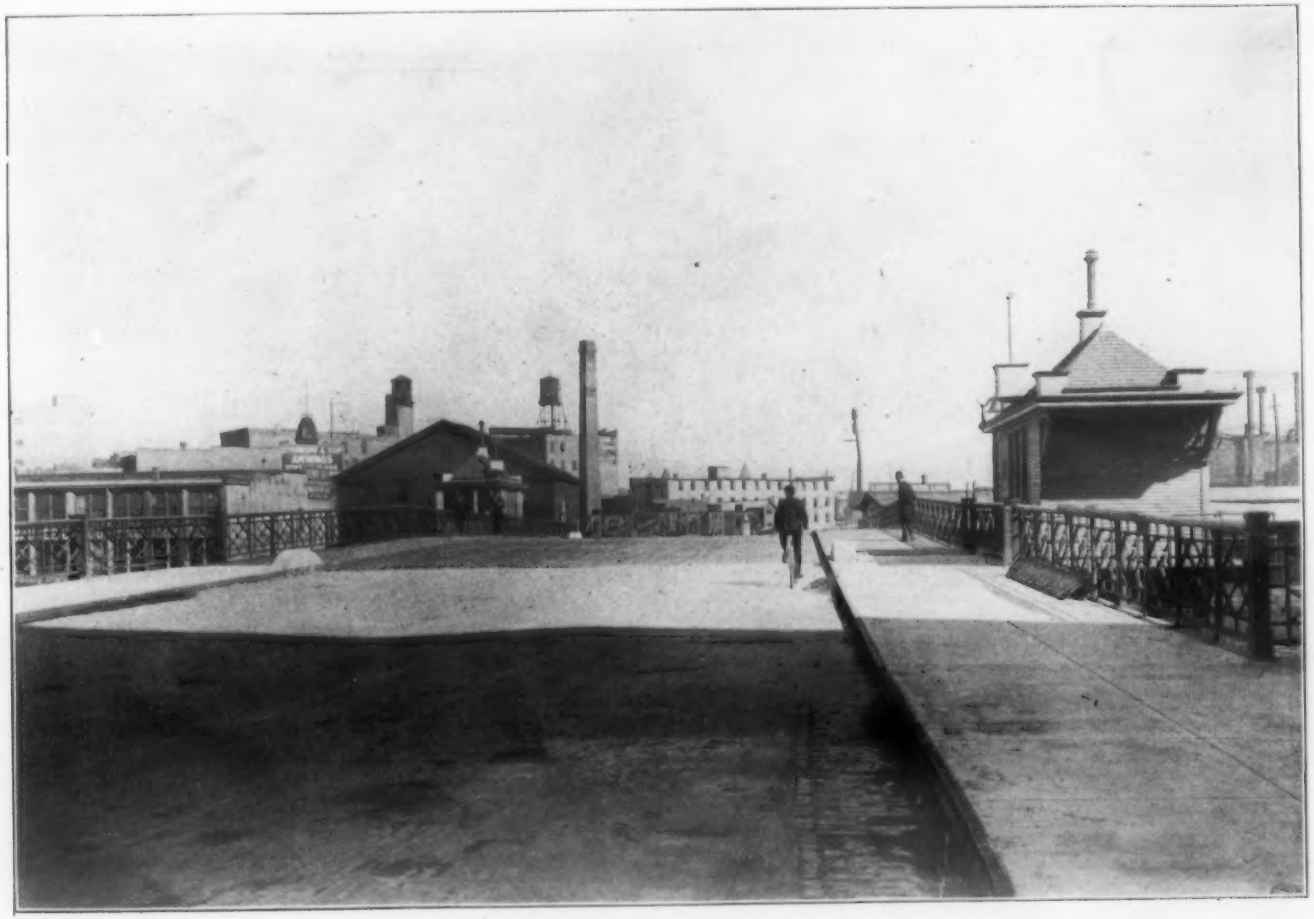
Where cinders are abundant a very good walk can be made with them for a sparsely settled community. Care should be taken, however, that cinders are used and not ashes. The sub-grade for the walk should be well drained by a lateral slope of at least one-half inch to the foot, and a liberal amount of cinders should be used, say six inches after being well tamped. One serious objection to cinder walks is their propensity of adhering to one's shoes thereby being carried to the house to grind out the carpets. A good cinder walk, however, is much preferable to mud.

Gravel walks are largely used in parks and private grounds. The gravel may be laid on the ground to a depth of four to six inches, or if the ground is soft a base of broken stone of macadam size may be laid to a depth of about four inches and a layer of gravel placed on this. Gravel walks are made in a great variety of ways depending largely on the kind and amount of material at hand. While good for parks and inside walks they are not so well adapted for sidewalks.

Boards—A cheap walk may be made by laying two lines of 12-inch boards parallel with the street line leaving a six-inch space between them. The boards should break joints at their centers and be supported by cross pieces joining the two boards and not more than four feet apart. The lumber should be one inch in thickness, reasonably straight grained and free from large knots.

A good plank walk can be made as follows: Use 2 by 6-inch oak for stringers and 2-inch white pine planks for the walk. The stringers should be blocked up so they will be free from the ground and at intervals of about eight feet. The planks should be laid about one-fourth of an inch apart and be nailed with three nails to each stringer unless the boards are very narrow. Two stringers will do for a walk three feet wide.

Brick—Only hard-burned brick should be used for walks. The sub-grade should be well drained and covered with about two inches of clean sand, gravel or cinders. After being laid the bricks should be tamped to an even grade by laying a plank on the walk and tamping it with a heavy tamper until the bricks come to an even grade. The bricks may be laid on the side and should break joints at the middle. After being brought to an



III. BROADWAY BRIDGE, MILWAUKEE, WIS. ROADWAY.

even grade the joints should be filled with sand.

Natural stone flagging should have an even surface and a depth or thickness proportionate to their area. The thickness required depends on the kind of stone used but should generally be not less than four inches for a stone four by six feet. They should be laid on a bed of sand, gravel or cinders and brought carefully to grade. The joints should be close and well made.

Hexagon block and granitoid make the finest walks for all portions of the city.

There are two methods of constructing granitoid walks and curbs. The alternate and the continuous.

By the alternate method each alternate stone as the first, third, fifth, etc., are formed first. When these alternates are set sufficiently, say in forty-eight hours, the templates are removed and the intermediate stones are put in. The progress is considerably slower than where the stones are made in continuous order. Some of the advantages are:

1—Complete separation of the stones.

2—Greater firmness of the forms, resulting in better lines and grades.

3—Better and easier finishing since the finisher can work all around each stone.

The principal objection to this method is its greater expense in labor and material, since the same ground must be gone over twice and it requires more lumber for forms, as the forms must be left in place from the time the alternate stones are made until the intermediate stones are set.

In the continuous method the forms are constructed in the same manner as in the alternate. Iron templates from one-eighth to one-fourth inch in thickness by four inches in width and of a length equal to the width of the walk, are used to form the plane surface of the stone and also to make a complete separation. These templates are withdrawn after the stones have been finished and before they become set. If withdrawn too soon the stone settles toward the opening leaving a low joint. If left in too long there is danger of breaking the stone in getting it out, hence judgment and care must be exercised in their removal.

Materials needed for forms—1—Side strips of best white pine lumber two inches by four inches by sixteen feet, free from knots, warps or cracks and dressed on all sides, since each time they are used they must be turned over to prevent warping.

2—One stake for about every two lineal feet of walk, stakes to be about two inches square and from two to four feet in length according to the nature of the soil.

3—Side strips for light curves may be thin four-inch strips held firmly in place by stakes and side bracing. If curves are sharp and short a strip of spring steel like a saw blade is sometimes used. Where longer and not too sharp a board may be curved to fit if at several places equidistant on the concave side it is sawed clear across and about one-third of the way through. If the same curve is of frequent occurrence it generally pays to have the forms sawed to the right curvature.

4—A dozen or more strips of steel one-eighth inch thick, four inches wide and of a length equal to the width of the walk. These are called templates and are used to separate the stone and also to form them.

5—Plenty of wire nails, principally sixes and eights.

Tools for form-setters—Saws, hammers, hatchets, spirit level, square, sledge, chalk line.

Tools for concrete gang—Wheel-barrows, shovels, screens, hoes, hatchet, iron tamps, iron-bound straight-edges trowels, buckets.

Tools for finishers—Iron-shod straight-edges, floats, trowels, edger, jointer.

A tool-box large enough to hold all the tools should be mounted on two wheels so it can be easily moved.

Construction—The first step toward constructing the walk is setting the line and grade stakes, which is done by the engineer. These stakes are usually placed two feet back from the back line or edge of the walk and where possible the same stakes are placed both for line and grade. The stakes should not be more than fifty feet apart on continuous grade and closer where the grade is broken or on curves. After the forms are in place the stakes should be tested by the engineer.

The excavating is now done after which the form-setters begin their work by driving stakes just back of the sidewalk line and opposite the line and grade stakes. A line is stretched between these stakes and set to line and grade. Stakes are now driven about four feet apart and the side pieces fastened to them by driving wire nails through the stakes and into the side strips, being careful not to drive the nails through the strips as they would injure the stone. The strips are usually nailed on while a trifle above grade and then brought to grade by driving the stake lightly.

Cinders—The cinders are now put in, thoroughly wetted and tamped so the

IV. MUSKEGO AVENUE BRIDGE, MILWAUKEE, WIS. ROADWAY.

surface of the cinders is four inches below the grade of the walk. This being done we are ready for the concrete. By the way, the engineer should watch the cement barrels or sacks when opened and see that the cement is all right; also that the gravel is clean and that the sand is of the right quality and has been properly screened. If the men are allowed to open the cement barrels after placing them on top of the gravel in the mixing box, see that they do not leave any splinters or dirt in the box.

Concrete—The concrete box should be large enough to hold two yards of gravel or crushed granite. A board can then be put across the center to hold the gravel until measured, the board is then removed, giving plenty of room for mixing. Some contractors prefer mixing on a platform. In this case the measuring is done in a box frame holding about a cubic yard. This frame consists of four pieces of 2-inch plank which form the four sides of a box. There being no bottom, this frame can be set on the platform and after being filled with gravel can be lifted off leaving the gravel in a pile on the platform. After the gravel has been measured the sand is spread over it and then the cement spread evenly over all. The mass is then turned over, with shovels from the bottom of the pile. After turning it twice dry, a sufficient amount of water should be added carefully so as not to wash the cement to the bottom of the pile. The concrete is then turned twice more, always being careful to shovel from the bottom of the pile and to cut clear across the platform. If the work has been done properly the concrete is now thoroughly mixed and is ready to be put in the forms. In taking the concrete to the forms see that your wheelbarrows are clean and do not run the wheelbarrows over or against the forms. The forms should be filled level full with concrete and then tamped with a heavy iron tamper until it is half an inch below the top of the forms; when thoroughly compacted a thin film of water rises to the surface if the right amount of water has been used in mixing. If it is quaky it is too wet. If no moisture comes to the surface it is too dry.

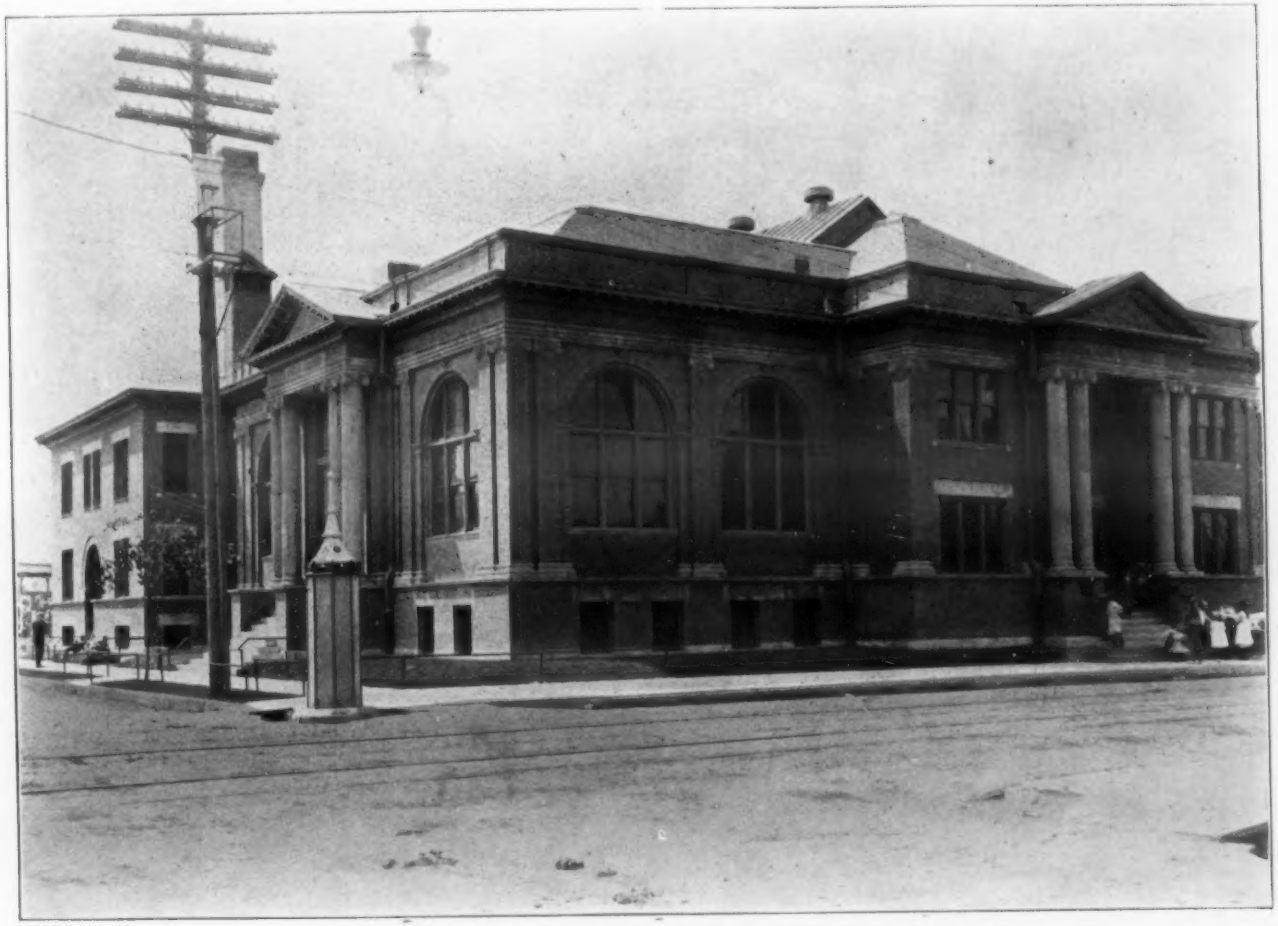
Wearing Surface—The top stuff or wearing surface should now be put on as soon as possible. This is usually made of one part of cement to one of sand by measure, and should be soft enough to run on easily with a trowel. It is spread on with a trowel and left a little above the top of the forms. After it has stood awhile an iron shod straightedge is run over it cutting it down even with the top of the templates. In a few minutes it is ready for the finisher, who floats it with a wooden trowel or darby, afterward smoothing it with a steel trowel. The edges and joints are formed with the edger and jointer guided by a straight edge.

The finishing should not be attempted while the stone is too soft as it gets it out of shape and is apt to make it hollow or uneven on the surface. Neither should the stone be left until too hard as it is then impossible to get a good, smooth finish. The steel templates should be left in place until the stone becomes firm enough to be self-supporting, otherwise if drawn out too soon the stone, being soft, will settle toward the opening thus formed and leave a low joint. After the stones are finished they should be covered or barricaded to keep off animals and pedestrians. The forms should not be taken away until the stone has set sufficiently, which will be twenty-four hours or more, usually. When taken away too soon the stones are apt to be broken or injured on the edges or corners.

Sprinkling—After the stones are about forty-eight hours old they should be sprinkled with water every morning and evening for about a week or ten days. In hot weather they should be covered during the hot part of the day so the sun cannot strike them, otherwise an uneven setting may take place which will weaken the stone and possibly cause it to warp or become distorted later on.

Should a stone be broken before it has set it can be repaired by removing the broken part and replacing with new material, care being taken that all shattered pieces are removed. After the stone has set, mending is not such an easy matter and most engineers will not allow it to be done, as in many cases the parts fail to fully unite. Remove, carefully, all of the broken and shattered pieces, brush out all the dust and wash clean; then brush in thoroughly, a thin paste made of neat cement and clean water, followed quickly by a mixture of one part cement to one of sand, the mixture to be tolerably stiff. Cover carefully to prevent drying out before having time to set.

Expansion joints should be made about every thirty feet. They should be a quarter to half an inch in width and be filled with bitumen.



V. NATATORIUM AND LIBRARY STATION, MILWAUKEE, WIS.

EDITORIAL COMMENT

Architects and Concrete Block Construction.

The National Association of Cement Users.

Investigations of Water Supplies.

ARCHITECTS AND CONCRETE BLOCK CONSTRUCTION.

This magazine has called attention frequently in the past to the need of expert design of buildings of concrete and concrete blocks. The architectural possibilities of these materials have not yet been developed. In fact, they have nearly always been concealed by the ignorance of builders of the first principles of art in architecture.

In a recent letter Mr. George D. Mason, an architect of Detroit, Mich., gives expression to the same idea in the following:

I have had many inquiries from builders and others who have been referred here to give an opinion as to the advisability of using cement blocks for building purposes and I have tried to instil into their minds that to be early in this line will be of great advantage to them. Architects, as a rule, interest themselves slowly in a new business, and, in my opinion, the principal reason why they have not taken up the cement building block business sooner is because much of the work already done has been carried out by men without any training in design, and therefore the general effect of the construction has not produced a favorable impression, because of the inartistic and clumsy ways in which it has been placed on exhibition.

If the firms who manufacture machines and blocks would only appreciate the fact that a good designer could and would handle the work in the same way that the best cut stone work is handled, they would take a long step in advance in making a favorable public impression with the material. All will agree that good designs of government and private buildings constructed of cut stone are well liked, and it would take an expert to tell the difference between stone and cement if both were equally well put together. The good designer is the principal missing link in the present condition of the business.

An important need also is for concerns properly equipped to contract for this kind of business. I could have put up several cement block buildings if I could have found the contractors competent and willing to undertake the work. Those who understand the handling of cement and do monolithic work complain of the lack of equipment and trained help to carry on block work.

Inasmuch as it enters directly into competition with cut stone work it seems to me that the cut stone contractors could make a profitable addition to their business by taking up the manufacture of cement blocks in connection therewith, for they have trained help with the knowledge necessary to properly lay out and joint the work. They would be able to give a customer whichever material was desired, and could give it to them in proper shape with credit to themselves and to the cement block business.

I have often thought that the terra cotta companies could also take up the manufacture of cement blocks, for they thoroughly understand the art of moulding and jointing the work, the same as the cut stone contractor, and with their facilities for coloring their own material might also gradually develop a good line of colors for cement work. I believe the possibilities for the development of this business along the lines I have suggested would result in a profitable business for such companies, at least in the earlier years of its development, as in later years the better understanding of the subject and greater competition would tend to lessen profits.

Mr. Mason is correct in his statement that architects are slow to take up the new material on account of the poor showing it has made from the artistic standpoint, and that this poor showing is due to the inexpert designers of concrete block buildings. Expert designers are to be found only in the ranks of the architects, so that the responsibility for the failure of the architects to take up designing in the new material lies with themselves. Their training and the traditions of their profession make them slow to investigate a new material and to experiment with it, and the inartistic and often defective form and construction of the blocks as too frequently presented have an additional retarding effect upon them.

A few architects with greater insight into the future and greater knowledge of the past of concrete have become conscious of the possibilities of concrete in architecture and the results of their efforts are seen in better designs of buildings and better forms and faces of blocks as constructed within the last year or two. These men will soon add recruits to their ranks and, with the development of

VI. POLICE STATION No. 4, MILWAUKEE, WIS.

competent contractors, the new methods of construction will in a few years displace much of the old and thus make this pre-eminently the cement age.

This magazine will keep in touch with the architects as they join the procession and add them to its lists as rapidly as they show themselves. The many inquiries received for names of architects paying attention to designs for concrete and cement block buildings will receive new answers each month as the names of new recruits among the architects are received.

One of the most popular subjects for discussion at the coming convention of cement users, in Indianapolis, Jan. 17, 18 and 19, 1905, will be the architectural possibilities of concrete, if one may judge by the number of requests for papers upon this subject.

Some in the cement trade have been discouraged over the low prices of cement for the past two years, but the development of other uses than this under discussion has been slow for similar reasons, and the argument of the pocket book, made possible by the low price of cement, has been the cause of much of the advance which has been made. All of the advance is sure and permanent and the demonstrations it is making will accelerate the expansion in the use of cement, so that the trouble for some years, after the present comparatively short transition period is passed, will be in the restriction in the use of cement on account of high price rather than on account of lack of demand. The demand has not fallen off during the past year, but it has so nearly balanced the supply that the mills which cannot operate most economically have been obliged to close, while, at the same time, those which can make cement at low cost have been pushed to their full capacity.

When the snowball in the architectural field begins to roll up more rapidly, with its increase in size, it will carry the cement market with it. In the meantime it will be well for the architects to get into line, for in this as in many other lines of work, "the early bird gets the worm."

THE NATIONAL ASSOCIATION OF CEMENT USERS.

The idea of the Association of Cement Users has developed rapidly during the past month. The original suggestion for the society came from makers of cement blocks who needed help in finding out what were the reasons for their troubles. So many men not accustomed to the use of cement have gone into the business of making blocks and furnishing them for buildings and have found that success was not so easy to attain as it seemed, that the suggestion was promptly taken up by many makers of blocks and the first intention was to form an association for the cement block trade.

It developed, however, that there are many men using cement in other ways who like the idea of an association for the interchange of views, as a medium of communication and as a central body to undertake investigations and collect the experiences of workers in cement in all its various applications. It was finally decided by those promoting the association to suggest the more general title of the Association of Cement Users, to which the adjective National may very properly be prefixed. Thus, while, on account of the earlier efforts in the cement block field, the number of cement block makers in attendance may be greater than of those in other lines of cement work, the program provides for all and there will be an opportunity for all to join in the organization of the association. The prospects now are favorable for an attendance so large that it may be thought advisable at future conventions to divide the association into sections for some of the sessions to consider the special problems of the various branches of work in which cement is used.

There is very evidently a place for the National Association of Cement Users. The cement manufacturers have their association. The chemists and engineers engaged in the design of structures, the preparation of specifications, and the testing of materials have their associations. These associations consider the problems of cement manufacture from one standpoint. The cement user has a different standpoint and he needs to consider the practical methods of using cement rather than the methods of manufacture and of choosing the cement and of preparing specifications. This need will doubtless be supplied by the new National Association of Cement Users.

The success of the organization will depend upon the enthusiasm of its members and their readiness to impart their information and the results of their experience. The expressions of interest are so numerous and so enthusiastic that there can be no doubt on this score. Cement users will be present from every State from Maine to Texas and Dakota to Florida, if their letters mean what

they say and there will be many of them.

The desire for exhibits of materials and machinery was expressed early by many and enough have already been offered to insure the success of this feature. There will be more cement block machines on exhibition than there were at the St. Louis exposition, and concrete mixers, cement, cement colors, cement shingles are already on the list for exhibition with full opportunity to add to the number until the convention is over.

The details of program, railroad and hotel rates, headquarters, place of meeting and of exhibition, etc., so far as completed up to the time of publication will be found in the last pages of this number of Municipal Engineering to go to press.

INVESTIGATIONS OF WATER SUPPLIES.

A recent report upon a joint investigation of the public water supply of the city of Indianapolis by the municipal authorities and the water company, and the differences in the conclusions drawn therefrom suggest some thoughts regarding the spirit and methods of making such investigations and of applying the results.

Many years ago the water company drew its supply from a gallery or horizontal well partly open and partly tunnel, and partly under the river. Wells were driven which for some years discharged into the gallery. As years went by the flow of water into the gallery, even though it was frequently extended, became insufficient to supply the demand and the pollution of the two streams, at the confluence of which the works are situated, endangered the purity of the supply. Deep wells were driven from which the water was raised and discharged into the gallery by compressed air. This process is expensive and the water is very hard, so that the company is now putting into operation a plant for filtering river water, which has been under construction for about two years.

It seems to be true that if the water in the gallery is drawn down below the level of the water in the river, a certain flow from the river takes place, but that when the level of water in the gallery is kept at the level of water in the river by supplying well water or filtered water as rapidly as it is required for consumption, the proportion of river water decreases. The report upon the investigation indicates this by means of bacteriological and chemical analyses. It also shows that the river, while certainly polluted, is better than many water supplies in this country.

These are the admitted facts in the case, and another fact, also admitted, is that a very large proportion of the private wells in the city, of which there are very many, are seriously polluted. A large number of them have been condemned by the city sanitarian, but subsequent examination has shown broken seals, showing that the wells have been again put into use

The floods of the spring of 1904 broke through the levees surrounding the water plant and flooded the gallery. This apparently called special attention to the water works conditions, and an increase in the amount of typhoid fever in the city not long after gave occasion for the agitation which resulted in the investigation and report referred to.

This report, made by Mr. George W. Fuller, acting for the company, and City Engineer B. J. T. Jeup and Dr. C. E. Ferguson, acting for the city, is a conservative, scientific statement of the case and makes some recommendations of improvements in the gallery to prevent any suspicion of contamination from the river and of methods of operating the plant. Its spirit is excellent and its recommendations are on the side of safety. It shows the conditions of the private water supplies of the city to be almost uniformly bad, and, while not fixing definitely the full responsibility for the occasional increases in the amount of typhoid fever in the city, gives data sufficient to show that the probabilities are in favor of the private wells as the source of most of it if not of all.

It seems to an unprejudiced observer that the agitators of the controversy are largely responsible for the spread of the disease. In another city the writer has observed the starting of a typhoid fever epidemic by the effects of a flood which made the public water supply for a season so muddy and unusable that recourse was made to private wells which had been condemned long before. In this case there was no question of the source of the fever, the wells, not the river. In Indianapolis a somewhat similar state of affairs existed last spring. An increase in the tendency to use the wells was induced by notices issued by the Board of Health to boil the city water and newspapers took up the cry. Unfortunately the emphasis was laid upon the boiling of the city water and the infrequent recommendations that the private well water be boiled also were over-

shadowed until they had little effect. The city's methods of collecting vital statistics were insufficient to determine beyond a doubt from what source the infection came in a great majority of the cases. This gave opportunity for inferences which were not justified by the facts when closer investigations were made.

The point to which attention is called at this time is the danger to the public health of an agitation based upon insufficient data, and upon erroneous statements of fact, and to the necessity of proceeding with care and with a clear perception of the consequences of certain courses of action. A scientific investigation and report should be the basis and the only basis of an attack upon existing conditions. One with insufficient basis, even if it has no ulterior motive, may easily do more harm than good and its good results are very sure to be offset in large part by the damage done.

THE QUESTION DEPARTMENT

PRODUCERS OF CREOSOTED PAVING BLOCKS.

Please name two or three of the largest producers of creosoted blocks for paving purposes.

H. H. G., Chicago, Ill.

The Republic Chemical and Creosoting Company, Indianapolis, Ind., and Minneapolis, Minn., has plants of large capacity for creosoting wood, especially wooden blocks for paving purposes. This company has produced by a process of development an oil for which special properties are claimed and uses it in treating blocks according to its Kreodone process.

The Terre Haute Creosoting Company, Terre Haute, Ind., creosotes wood for paving and other purposes, their special product having the name Creoline, and pavements laid with blocks treated with it being termed "creoline wood block pavements."

The United States Wood Preserving Company, New York City, also creosotes blocks and lays them in pavements. Descriptions of this creoresinate process state that rosin is used to impregnate the blocks after the creosote has been put in.

EFFECT OF OIL UPON ASPHALT AND BITUMINOUS MACADAM PAVEMENTS.

The information about the reference given on page 437 of your December issue regarding the effect of oil upon asphalt pavements is too indefinite and bituminous macadam is not referred to. I am greatly interested in the subject and wish to enforce the ordinance, No. 21,233 of this city, a copy of which I enclose for your information. Any suggestions that you can make tending to enlighten me on the subject will be greatly appreciated.

R. D. B., St. Louis, Mo.

As stated in vol. xxvii, p. 437, in the answer to question under the heading "Effect of Oil on Asphalt Pavements," the references to back numbers of Municipal Engineering are to articles noting the fact that there has been trouble with oil dropping on asphalt pavements and that ordinances had been passed in the cities named regulating the transport of oil on such pavements.

The St. Louis ordinance sent by our correspondent is as follows:

An ordinance for the protection of asphalt and bituminous macadam pavements.

Be it Ordained by the Municipal Assembly of the City of St. Louis, as follows:

Section One. That no person shall pour or spill, or permit to drip upon any asphalt or bituminous macadam pavement laid on any street or alley or public place in the City of St. Louis any kerosene, benzine, gasoline or other similar oil or oily substance or liquid, or salt or salt water.

Section Two. All oil delivery wagons or tanks shall have securely fastened under the taps or faucets thereunto attached, an absolutely oil or water-tight zinc-lined box or tray, and in filling any measure or other vessel from said taps or faucets, such measures or other vessels must be held so that any drip or

overflow shall flow into said box or tray; and in removing the same from over the asphalt or bituminous macadam pavement no drip or overflow from such measure or other vessel must be permitted to fall upon such pavement, and no receptacle for holding oil shall be placed on the asphalt or bituminous macadam pavement.

Section Three. All automobiles and auto-cycles and all other vehicles using kerosene, benzine, gasoline or other similar oils, shall be provided with a pan or pans or other efficient receptacles so that no drip or overflow shall fall upon the asphalt or bituminous macadam pavement.

Section Four. All wagons delivering or hauling or handling ice cream shall haul away and not deposit or throw upon any asphalt or bituminous macadam pavement any salt water or salt, nor shall they deposit upon such pavement any receptacle which contains salt or salt water.

Section Five. Any violation of or failure to comply with the provisions of this ordinance shall be punished by a fine of not less than five dollars and costs, nor to exceed one hundred dollars and costs.

Section Six. It shall be the duty of the License Collector to refuse to issue a license for oil delivery wagons, tanks, automobiles, auto-cycles and other vehicles using or transporting kerosene, benzine, gasoline or other similar oils, unless the provisions of this ordinance are complied with

Approved October 12, 1903.

It is well known that bituminous materials such as asphalt and coal tar are soluble to a greater or less extent in lighter oils. The use of residuum oil or maltha as fluxes in making asphaltic cements for paving purposes is based upon this principle, though they are heavy oils, but little removed from the solid state at ordinary temperatures. Some methods of analysis of asphalts and coal tars depend upon the solution of certain constituents of asphalt in light oils. In making asphaltic mixtures for paving purposes the use of too much oil softens the pavement too much and gives rise to waves, soft spots and too rapid destruction. It is claimed that a properly mixed wearing surface will absorb oil from a binder course carrying too much oil and ultimately become too soft on this account.

These are the reasons for the statements made in the December number, that oil will injure asphalt pavements by softening them. Bituminous macadam pavements are made of asphalt or tar, bituminous materials soluble in oil. The effect of oil upon them would therefore be similar. It is probable that the effect of the oil would not be quite so serious on a bituminous macadam pavement below the thin wearing surface coat as on an asphalt pavement because the proportion of bituminous material is so much less in the former, but oil will have a very objectionable effect on both and should not be permitted to drop upon the pavement or to remain there.

The following articles on the relations of asphalts and oils, to be found in back numbers of Municipal Engineering, will be of interest as showing the effect of certain oils and other solvents upon asphalt, when used for certain purposes:

"Solvent Action of Ethylic Alcohol Upon Asphalts," vol. vi, p. 276.

"Petrolene in Its Relation to Asphalt Pavements," vol. vii, p. 75.

"Oil Residuum in Asphalt Paving Compounds," vol. vii, p. 118.

"Maltha as Flux for Asphalt Pavements," vol. vii, p. 167.

"Durability of Asphalt Pavements," vol x, p. 440.

"Softening Agents for Asphalt Paving Cements," vol. xii, p. 343.

"Solution of Asphalt Hydro-Carbons in Heavy Petroleum Oil," vol. xiii, p. 67.

"Residuum as a Flux for Asphalt," vol xvi, p. 353.

"Causes of Failure of Asphalt Pavements," vol. xviii, p. 18.

STEAM JACKETED VALVE.

I desire a steam jacketed valve for an asphalt kettle for use at the point where the asphalt leaves the kettle. A three-inch valve is used for taking the asphalt out, set close to and outside the kettle on the outside pipe.

H. M., Lincoln, Neb.

The only valve of this sort known to the writer is a steam jacketed plug cock made by Walter A. Forman, 17 Battery Place, New York City. Can our readers refer us to others?

CITY ENGINEERS IN THE UNITED STATES.

We are anxious to secure an accurate enrollment of the city engineers of all cities in the United States east of the Mississippi River.

A. M., New York City.

The most recent list of city engineers will be found in the "Directory of American Cement Industries" ($5). It includes in its "Directory of Engineers and Others Supervising the Use of Cement"

the names of city engineers of cities of 2,000 population or more and some engineers in smaller cities.

The "Municipal Manual" ($3) and Hendrick's "Directory of Architectural Trades and Professions" ($7) also give names of city engineers, but the latest editions of these books which have been issued are older than the "Directory of American Cement Industries," the latest edition of which was issued in June, 1904.

CENTRAL STATION HEATING PLANTS.

The writer is seeking data concerning public heating plants and begs to inquire if you have any information along that line on either private or municipal plants in towns having a population under 15,000.
P. H. S., Coldwater, Mich.

In earlier volumes of Municipal Engineering will be found some valuable information about central station heating plants to which reference may be made. Articles by Alton D. Adams on "Central Station Heating" will be found in vols. xviii, p. 351, and xx, pp. 65 and 136; articles by W. H. Schott in vol. xviii, p. 156 and vol. xxvii, p. 450; one on the Smead system in vol. xviii, p. 411, and vol. xx, p. 243; one by H. J. Frith on exhaust steam in vol. xix, p. 35; answers to questions and editorials on the subject in vol. xix, pp. 65, 212, 218, 413, vol, xx, p. 152; an article by W. H. Bryan on rates in vol. xx, p. 195; descriptions of plants at Owatonna, vol. xxii, p. 105, and at Indianapolis, vol. xxv, p. 329. In vol. xix, p. 413, will be found a collection of statistics of central station heating plants made by this magazine.

A number of circulars were sent to heating plants by this magazine early in the present year, to which there were quite general responses. The magazine also has access to some information gathered by Charles Carroll Brown, M. Am. Soc. C. E., during a special study of the success of central heating plants and has collected these data in the accompanying tables so far as it was possible to tabulate them. Some of the information having been obtained under the promise that the name of the plant giving it would not be published, it has been thought best to omit the names of all the plants. The table includes information for the year 1903 and in most instances includes the heating season of 1903-4.

The above inquiry being for plants in small cities, it may be stated that the plants bearing the following numbers are in cities and towns of less than 15,000 inhabitants: In the hot water table, 1, 3, 6, 9, 11, 15, 16, 17, 18, 19, 20, 22, 25, 26, 28, 29, 30, 31, 32, 33, 36; in the steam table, 6, 7, 8, 11, 16, 20, 22, 23, 25, 26, 30. The following are in cities of 15,000 to 20,000 population: Hot water, 5, 13, 35; steam, 2, 12, 14, 15. It should be understood also that in the larger cities the district system is in vogue so that with but few exceptions all the plants may be considered as suited for cities of less than 20,000 population.

The list of cities having central station heating plants is the most complete that has yet been published, but may fall a little short. Additions and corrections will be thankfully received.

In the hot water table rates have been reduced to cents per square foot of radiating surface as nearly as this rate can be estimated in case the rates are on a different basis. Thus plant No. 1 has a rate of 4-9 cent per cubic foot of contents of building; No. 4, 1-3 cent per cubic foot formerly, now changed to 20 cents per square foot of radiation provided this is not more than ½ cent per cubic foot of building. In several cases rates have been raised since the works were started as shown in the two columns of rates. The price of coal is generally per short ton delivered on cars at the works. The kinds of coal used are shown by the abbreviations of names and are variously called steam, screenings, washed nut, bituminous, slack, mine run. Most hot water plants are run in connection with power plants which furnish exhaust steam for heating some portion if not all of the water necessary for the service.

The system of steam distribution used in the steam plants so far as reported is the Holly with the exception of No. 6 using the Myers, and No. 23 the Bates. In the column headed "Radiation served, sq. ft., or cu. ft. of space, the figures in millions are cubic feet of space in buildings served and those in thousands are square feet of radiating surface of heaters. In the last column, plants marked "Ind." are heating plants only. Those marked "Dep.," "E. L.," "Ice," take the exhaust steam from power stations of kind not named, electric light stations and ice factory, respectively.

The following cities, with populations given, have central stations and hot water plants:

Idaho—Boise City, 5,957.

Illinois—Alton, 14,210; Belvidere, 6,937; Bloomington, 23,286; Evanston, 19,259; Mattoon, 9,622; Mt. Vernon, 5,216; Oak Park; Paris, 6,105; Paxton, 3,036; Peoria, 56,100; Springfield, 34,159.

CENTRAL STATION HEATING PLANTS USING HOT WATER.

No.	Date of Installation	System	Temperature Hot Water	Temperature Return Water	Max. Distance Water Carried, Feet	Length of Pipe, Feet	Area of City Served, Sq. Mi.	No. Buildings Served	Radiation Served, Sq. Ft.	Present Rates, Sq. Ft. Rad. Surface	Former Rates, Sq. Ft. Rad. Surface	Price of Coal	Kind of Coal	Payment to City	Length of Service	Is Financial Return Satisfactory	Cost of Plant
1	1899	Yaryan	140–215	106–171	4,000	52,000	.....	500	.....	18	13.5	$2.00	Steam	.....	.....	Especially not last year	400,000
2	1901	.....	.....	.....	.....	50,200	1.	460	289,000	17	.....	2.00	.....	5% gross	All year	No	300,000
3	1892	Natural	170	Wastes	15,000	31,000	.....	60	.....	$75 for ⅜ in. waste, to $90 for ¾ in.	May raise	None	.....	.....	.....	Fairly so	.....
4	.....	.....	.....	.....	.....	31,000	.....	165	.....	12.5—20	.....	2.00	.....	.....	.....	Yes	.....
5	1900	Yaryan	150–210	130–185	6,600	30,000	.....	120	.....	20	13.3	2.05-2.15 2.45-2.60	Screenings Washed nut	None	Sept. 15 to May 15	No	180,000
6	1903	Myers	200–180	180	4,000	26,000	.....	.....	.....	20	.....	1.40	Steam	.....	.....	Yes	.....
7	.....	.....	.....	.....	.....	26,000	.....	200	.....	18	.....	1.10	.....	.....	.....	Yes	.....
8	1900	Yaryan	170–200	152–172	5,000	21,000	.....	75	70,000	18 stores, 20 res.	12.5 and 15	1.65	Bituminous	.....	.....	Yes	.....
9	.....	.....	140–200	115–180	.....	21,000	.....	.....	.....	Costs same	as coal	3.50—4.00	.....	None	.....	Yes	.....
10	.....	.....	.....	.....	.....	20,000	.....	100	.....	15	.....	1.30	.....	.....	.....	Yes	.....
11	1897	Yaryan	100–212	60–152	5,293	18,000	.....	185	102,000	17	15 and less	1.70 2.20	Slack and Hocking Sl.	.....	.....	Yes	.....
12	.....	Yaryan	.....	.....	6,600	18,000	.....	400	.....	16.7	12 and 14	1.55 2.23	Slack and Jackson pea	None	8 months	Yes	266,000 3 plants
13	1902	Schott	120–200	110–185	5,000	15,000	.....	115	80,000	17	.....	2.25	Indiana M. R.	.....	.....	Not 1st year	.....
14	.....	.....	.....	.....	.....	15,000	.....	78	.....	15	.....	2.15	.....	.....	.....	Yes	.....
15	1899	Yaryan	160–200	130–170	5,000	10,000	0.25	120	100,000	18	15	1.80—2.00	Steam & M. R.	.....	.....	No	.....
16	1899	Yaryan	150	125	2,000	10,000	.....	125	88,000	20	15	1.64	Steam	.....	.....	Fairly	.....
17	1899	Yaryan	140–212	120–192	3,500	9,000	.....	.....	55,000	20	15	2.88—2.12	M. R. and Sl.	None	.....	Yes	.....
18	1900	E.A. & Co	.....	.....	5,000	8,000	.....	28	25,000	17.5	.....	3.20	Illinois M. R.	.....	.....	Partially	.....
19	.....	.....	.....	.....	.....	.....	12 blks.	.....	.....	20	13	2.50	Steam	.....	All year	Yes	.....
20	1903	Schott	200	180	5,000	5,000	.....	20	18,000	15	.....	2.30—3.00	Nut and Slack	.....	.....	No, on acc.	of leakage
21	.....	.....	.....	.....	.....	5,000	.....	100	.....	15	.....	1.50	.....	.....	.....	Yes	.....
22	1900	.....	.....	.....	5,000	.....	.....	.....	.....	17 and 20	12.5 to 20	.....	.....	Cy bldgs.	Sept—May	No	.....
23	.....	.....	.....	.....	.....	1,200	.....	100	.....	18 and 20	1.85	.....	.....	.....	.....	Yes	.....
24	.....	.....	.....	.....	.....	.....	6.	.....	.....	16.7	.....	1.875	Mine run	3c. per l. ft	When need.	Probably	2 plants
25	.....	.....	.....	.....	.....	.....	3.5	.....	.....	15	.....	1.85	Slack	2% gross	Sept.—June	Yes	.....
26	1901	Yaryan	.....	.....	.....	.....	1	.....	.....	15	.....	2.00	.....	None	Sept.—June	.....	.....
27	1903	.....	.....	.....	.....	.....	0.5	.....	.....	15	.....	1.15	.....	None	9 months	.....	.....
28	1900	.....	.....	.....	.....	.....	0.5	.....	.....	.....	.....	2.33	.....	None	When need.	Not in 1903–4	.....
29	1899	E.A. & Co	180	170	5,500	7,000	0.047	.....	29,000	20	15	2.25	.....	None	Oct. 1–May 1	Yes	10,000
30	1900	Yaryan	180	150	4,000	.....	.....	.....	25,000	15	12.5	1.00 1.45	Screenings Mine run	.....	.....	Yes	.....
31	1900	Yaryan	.....	.....	5,000	.....	.....	.....	86,000	20	15	2.15	Washed scr.	.....	.....	Yes	.....
32	1901	E.A. & Co	140 to 210	125 to 190	400	.....	.....	2	4,000	20	.....	3.50	Bituminous	.....	.....	No	.....
33	1899	Yaryan	130–200	120–150	8,000	.....	.....	76	68,000	20, says it sh'ld be 25	15	2.60	Indiana M. R.	.....	.....	No	.....
34	1899	Yaryan	150–210	110–175	8,000	.....	.....	.....	70,000	18	15	.....	.....	.....	.....	.....	.....
35	.....	E.A. & Co	180	168	.....	.....	.....	.....	.....	15	.....	.....	.....	.....	.....	No	.....
36	1898	Yaryan	160–200	150–170	8,000	.....	.....	.....	5,000	12.5	.....	.....	.....	.....	.....	.....	.....
37	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2% gross	Sept. 15–May	.....	.....
38	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	Yes	.....

CENTRAL STATION HEATING PLANTS USING STEAM.

No.	Date of Installation.	Pres. of steam, lbs. per sq. in.	Max. dist. heat is carried, ft.	Length of pipe, ft.	Area of city served, sq. mi.	No. bldgs. served.	Radiation served, sq. ft. or cu. ft. of space.	Rates per sq. ft. radiating surface.	Rates per 1,000 lbs. condenser water.	Rates per 1,000 cu. ft. space heated.	Price of coal.	Kind of coal.	Payment to city.	Length of service.	Is financial return satisfactory?	Independent or not.
1	1894	50	5,000	84,000	65	700	500,000	.20–.30	.....	$4.00	$1.50	Steam	None.	Sept. 15–June 1	Fairly so.	Ind.
2	1876	.....	.....	34,000	.....	.....	.....	.....	$0.50 s	.....	2.00–3.00	Bitum	Franchise tax on $18,000	Oct. 1 to May 15	.....	.....
3	1880	40	8,000	29,000	.....	165	.....	.60–.90	.....	.....	1.20	Lignite sl.	.....	.....	No.	Ind.
4	1886	10–40	2,600	26,000	.....	350	16,000,000	.....	.....	4.62–6.16	1.80	Buck No. 1	.....	.....	Yes.	Ind.
5	1900	5–7	2,600	26,000	.....	225	100,000	.10 to .30	.....	.....	1.25	Bitum	.....	.....	Yes.	E. L.
6	1903	15–25	4,000	26,000	.....	.....	.....	.35	.....	.....	1.40	Steam	.....	.....	Yes.	Ind.
7	1883	45	8,000	21,000	.....	250	.....	.....	.....	.....	2.05	Bitum	.....	.....	No.	Ind.
8	.....	8	4,000	21,000	.....	213	73,000	.....	0.45 w	.....	1.10	Bitum. sl.	.....	.....	.....	Ice.
9	1887	20	8,000	20,000	.....	265	9,000,000	.....	.....	.....	3.00	Bitum	.....	.....	Fairly.	Ind.
10	1890	2	2,700	16,000	.....	250	125,000	.50–.30	.....	.....	2.00	Lignite	.....	.....	Fairly.	E. L.
11	1901	1–10	3,600	13,000	.....	74	55,000 / 3,500,000	.25	.....	.....	1.35 / 7c m	Bitum. / Nat. gas	.....	.....	.....	E. L.
12	1896	5–15	4,300	13,000	.....	350	150,000	.....	.....	2.50–6.00	1.00	Bitum	.....	.....	Yes.	E. L.
13	1892	15	4,500	10,000	.....	167	120,000	.....	0.47 w	.....	2.–2.25	Steam	.....	.....	No.	E. L.
14	1888	20–35	7,500	10,000	.....	200	4,500,000	.36	.....	84.87	1.50	Buck	.....	Oct. 1–June 1	Fairly.	Ind.
15	1888	10	4,000	10,000	.....	140	5,000,000	.....	.....	4.00	3.00	Bitum	.....	.....	Yes.	Ind.
16	1883	40	2,500	10,000	.....	150	65,000	.20	.....	.....	1.40	Bitum	.....	.....	No.	Ind.
17	1901	6	2,042	9,567	.....	60	4,500,000	.....	.50–.60 pr 100 gal. ws	.....	3.75	Pocahontas	.....	.....	Yes.	E. L.
18	1897	7–12	7,300	8,000	.....	200	.....	.....	.....	3.50	1.60	Slack	.....	.....	Yes.	E. L.
19	1889	5–20	1,760	5,000	.....	80	2,000,000	.....	.....	3.00	1.50	Rice & Buck	.....	.....	No.	E. L.
20	1897	5–10	5,000	5,000	.....	65	.....	.....	.....	2.50–3.50	1.15–2	Slack, nut and lump	.....	.....	No.	E. L.
21	1900	2–8	4,500	.....	.....	75	10,000,000	.....	.....	.....	1.75	Mine run	.....	.....	Yes.	Ind.
22	1901	1–5	3,000	.....	.....	32	20,000	.25	.....	.....	75–1.75	Bitum	.....	.....	Fairly.	E. L.
23	1899	1–6	1,500	2,000	.....	.....	12,000	.25–.30	.....	.....	2.75	Bitum	.....	.....	No.	E. L.
24	1901	1–5	3,500	.....	.....	14	5,049,607	.....	0.40 w	.....	1.50	Lignite	.....	.....	Yes with exhaust steam.	E. L.
25	1895	1–5	1,000	.....	.....	.....	25,000	.35	.....	.....	2.10	Screenings	.....	.....	Yes.	E. L.
26	1899	5	1,000	.....	.....	35	.....	.....	.....	.....	5.50	Yough. scr	.....	.....	Yes.	Ind.
27	.....	.....	.....	.....	3.5	.....	.....	.....	0.40 w	.....	1.50	.....	None.	Sept. 1–June 1	Yes.	.....
28	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	2.00	Buck	None.	Oct. 1–June 1	No, div.	.....
29	.....	.....	.....	.....	0.5	.....	.....	.25	.....	.....	1.15	.....	None.	9 months	Yes.	.....
30	.....	.....	.....	.....	10 or 12 blks.	.....	.....	.....	.....	.....	1.00	Slack	City bldg.	All year.	.....	.....
31	.....	35	.....	21,000	.....	500	.....	.....	.....	4.66	2.30	.....	.....	.....	.....	Ind.
32	.....	5–20	.....	15,000	.....	300	.....	.....	.....	.....	2.70	.....	.....	.....	Yes.	Ind.
33	.....	2.5–15	.....	12,000	.....	350	.....	.....	.....	6.00	1.25	.....	.....	.....	Yes.	Dep.
34	.....	5–28	.....	11,500	.....	330	.....	.....	.....	4.95	3.58	.....	.....	.....	Yes.	Ind.
35	.....	1–6	.....	10,000	.....	275	.....	.27	0.50 w	.....	1.30	.....	.....	.....	Yes.	Dep.
36	.....	5	.....	7,700	.....	150	.....	.25–.30	0.60 w	.....	1.60	.....	.....	.....	Yes.	Dep.
37	.....	15–20	.....	7,000	.....	82	.....	.....	0.60 w	.....	1.25	.....	.....	.....	Yes.	Ind.
38	.....	2–6	.....	5,900	.....	130	.....	.30	0.60 w	.....	2.50	.....	.....	.....	Yes.	Dep.
39	.....	4–8	.....	4,930	.....	53	.....	.....	0.50 w	.....	4.00	.....	.....	.....	Yes.	Ind.
40	.....	50	.....	4,500	.....	600	.....	.30	.....	.....	1.10	.....	.....	.....	Yes.	Ind.
41	.....	3–5	.....	3,000	.....	28	.....	.25	.....	.....	1.50	.....	.....	.....	Yes.	Dep.
42	.....	5	.....	3,000	.....	35	.....	.....	0.50 w	.....	1.75	Wood per cord	.....	.....	Yes.	Dep.

Indiana—Bedford, 6,115; Bloomington, 6,460; Boonville, 2,846; Connersville, 6,836; Elwood, 12,950; Indianapolis, 169,164; Lafayette, 18,116; Laporte, 7,113; Marion, 17,337; Newcastle, 3,406; Peru, 8,463; Princeton, 6,041; Sullivan, 3,118; Terre Haute, 36,673.

Iowa—Carroll, 2,882; Cresco, 2,806; Des Moines, 62,139; Ida Grove, 1,967; Iowa Falls, 2,840; Mason City, 6,746; Missouri Valley, 4,010; Oklaloosa, 9,212; Perry, 3,986; Red Oak, 4,355.

Minnesota—Albert Lea, 4,500; Owatonna, 5,561.

Missouri—Kirksville, 5,966.

Ohio—Ada, 2,576; Bowling Green, 5,067; Columbus, 125,560; Coshocton, 6,473; Delaware, 7,940; Fremont, 8,439; Toledo, 131,822; Washington C. H., 5,724.

Pennsylvania—West Chester, 9,524.

Wisconsin—Janesville, 13,185; Kenosha, 11,606; Lacrosse, 28,895.

The following cities have central station steam heating plants:

Alabama—Birmingham, 38,415.

Colorado—Colorado Springs, 21,085; Denver, 133,859.

Connecticut—Bristol, 6,268.

Georgia—Atlanta, 89,872.

Illinois—Champaign, 9,098; Clinton, 4,452; Danville, 16,354; Dekalb, 5,904; Hillsboro, 1,937; Springfield, 34,159; Taylorville, 4,248; Urbana, 5,728.

Indiana—Indianapolis, 169,164; Muncie, 20,942.

Iowa—Cedar Rapids, 25,656; Davenport, 35,254; Des Moines, 62,139.

Kansas—Topeka, 33,608.

Massachusetts—Pittsfield, 21,766.

Michigan—Detroit, 285,704; Grand Rapids, 87,565; Menominee, 12,818.

Minnesota—Crookston, 5,359.

Missouri—Kirksville, 5,966.

New York—Geneva, 10,433; Lockport, 16,958; Newark, 4,578; Newburg, 24,943; New York, 3,437,202; Penn Yan, 4,650.

North Dakota—Grand Forks, 7,652.

Ohio—Lima, 21,723; Youngstown, 44,885.

Pennsylvania—Allentown, 35,416; Bangor, 4,106; Bellefonte, 4,216; Clearfield, 5,081; Harrisburg, 50,167; Johnstown, 35,936; Lebanon, 17,628; Philadelphia, 1,293,697; Pottsville, 15,710; Reading, 78,961; Renovo, 4,082; Scranton, 10,925; Shenandoah, 20,326; Washington, 9,970; Wilkesbarre, 51,721; Wilkinsburg, 11,886.

Rhode Island—Pawtucket, 39,231.

Washington—Seattle, 80,671.

The following cities are said to have central station heating plants but no reports have been received stating what methods are in use:

Connecticut—New Haven, 108,027.

Illinois—Charleston, 5,488; Decatur, 20,754; Jerseyville, 3,517; LaSalle, 10,446; Quincy, 36,252; Sycamore, 3,653.

Indiana—Vincennes, 10,249.

Iowa—Boone, 8,880; Burlington, 23,201; Grinnell, 3,890; Marion, 4,102; Ottumwa, 18,197; Webster City, 4,613.

Kansas—Ft. Scott, 10,322.

Maryland—Cumberland, 17,128.

Michigan—Houghton, 3,359; Lansing, 16,485.

Minnesota—St. Cloud, 8,663; St. Paul, 163,065.

Missouri—Kansas City, 163,752; St. Joseph, 102,979; Sedalia, 15,231.

Montana—Butte, 30,470.

New Hampshire—Laconia, 8,042.

New York—Auburn, 30,345; Dunkirk, 11,616; Fredonia, 4,127; Hornellsville, 11,918; North Tonawanda, 9,069.

North Dakota—Bismarck, 3,319.

Ohio—Van Wert, 6,422.

Pennsylvania—Bloomsburg, 6,170; Erie, 52,733; Greenville, 4,814; Hazelton, 14,230; Lock Haven, 7,210; Mahanoy City, 13,504; Mt. Pleasant, 4,745; Phillipsburg, 3,266; Towanda, 4,663; York, 33,708.

Texas—Waxahachie, 4,215.

Utah—Salt Lake City, 53,531.

Wisconsin—Marinette, 16,195.

The following cities formerly had central station heating plants but they have been discontinued, mainly because they were not profitable: Springfield, Mass.; Columbus, O.; Muscatine, Ia. These were all steam heating plants.

MANUFACTURERS OF LIME KILNS AND LIME HYDRATING MACHINERY.

Will you kindly give us the names of manufacturers of kilns for lime burning, and also the names of manufacturers of appliances for hydrating lime?

K. D. S., —, Mich.

The following are manufacturers of lime kilns: Broomell, Schmidt & Steacy Company, York, Pa.; James O'Connell, 651 W. One Hundred and Thirty-first-st., New York City; Eldred Process Company, 208 Fifth-ave., New York City; Petroleum Iron Works Company, Washington, Pa., and Penn Building, Pittsburg, Pa.; William Swindell & Bros., German National Bank Building, Pittsburg, Pa.

Manufacturers of lime hydrating machinery and owners of special processes are as follows: Clyde Iron Works, Duluth, Minn.; James O'Connell, 651 W. One Hundred and Thirty-first-st., New York City; Charles A. Teal, 1361 Ridge-ave., Philadelphia, Pa.; the White Rock Company, Toledo, O.

WATERPROOFING A CONCRETE WALL.

I wish to waterproof a concrete retaining wall, mixture about 1:3:6 or even 1:4:8. Do you know whether roofing asphaltum would give satisfactory results on a vertical wall. Has either tar or some heavy bridge paint ever been tried for this purpose? B. J. LAMBERT,
Iowa City, Ia.

The best collective statement of practice in making concrete waterproof will be found in Edwin Thacher's paper on "Concrete and Concrete—Steel in America" before the International Engineering Congress at St. Louis. Part of the paper was printed in the December number of Municipal Engineering and on page 444 will be found the statement that a concrete-steel water tank was made perfectly water tight by plastering the inside with 1:2 mortar to which had been added a solution of caustic potash and alum.

Another portion of the paper will be found in this January number in which it is stated that 1 per cent of powdered alum added to the dry mixture of the cement and sand and 1 per cent of potash soap (ordinary soft soap) added to the water before mixing will make mortar impervious. Another formula is a 5 per cent solution of alum in water and a 7 per cent solution of soap, the two solutions being used in equal parts in mixing the mortar or concrete.

The uses of the proper proportion of cement and mortar to fill all voids, plasters of rich mortar, alum and lye washes, and asphalt coats are also detailed. Which is best for a certain use depends upon the cost, the effect upon appearance, the ease of application, the exposure to weather, etc., and must be determined for the particular local conditions.

MANUFACTURE OF CEMENT POSTS AND BLOCKS.

I find references in your September number to vol. xxvi, pp. 213 and 241, for articles on cement posts. Can these two articles be obtained yet?

I would like to put up some outbuildings, chicken houses, hog houses and others with blocks, but do not like to buy expensive machinery and patent rights, blocks about 8 by 8 by 16. Where could I buy molds at a reasonable price? I have seen block 12 by 12 by 24, too big for small buildings. We have very good pit sand here. J. A. H., Carroll, Ia.

The two articles are in the March and April numbers, 1904, and will be sent for 25 cents each. There are several descriptions of cement posts and cement post machines in the March number. The article in the April number is on the effect of frost upon cement posts and how to guard against damage.

The best place to get information about the various cement block machines is in the numbers of Municipal Engineering in both reading and advertising pages. A simple and small mold is evidently desired for the work proposed and such will be found mentioned in the advertising pages each month. Some of them have been described in the department of "Machinery and Trade" and others will be considered in future numbers.

ARCHITECT MAKING PLANS FOR CONCRETE BUILDINGS.

I would like the name and address of a firm or firms or architect who publishes designs and plans for strictly concrete dwellings. P. S. C., Plymouth, Q.

This question has been answered frequently by reference of inquirers to the "Business Directory," published in each number of Municipal Engineering under the headings, "Architects" and "Civil Engineers." Reference may be made also to this department in vol. xxvii, p. 436, for additional name. R. L. Day of Huntington, W. Va., may be added to the list

QUALITIES OF CEMENT SEWER PIPE.

I am contemplating the manufacture of cement sewer pipe and write to learn your opinion of this product. Do you consider it substantial and equal to earthen pipe? Please also state to what extent cement sewer pipe has been used and whether with satisfactory or unsatisfactory results.
S. N. P., Greensboro, N. C.

Cement sewer pipe has been used to some extent in this country for perhaps thirty years. It was formerly used quite generally in Brooklyn, N. Y., but for some reason unknown to the writer was discontinued. Within two years there have been several cement sewer pipe machines devised and put on the market and this doubtless means that the use of cement pipe for sewers is becoming more general. However, no definite information of amount of pipe used, cost, etc., has been received at this office.

The larger cities are using concrete laid in place for building large sewers to a considerable extent, the rapid extension in the use of concrete for this purpose beginning about two years ago. Concrete

is used alone or reinforced with steel, and in a few instances concrete blocks have been used.

There have been complaints of porous pipes, disintegration of concrete, heavy weight of pipes to handle, but these difficulties have been overcome by using a sufficient proportion of cement, especially on the inner surface, and proper materials and methods of mixing them. Pipes are now made with steel reinforcement, permitting the reduction in weight.

Unless subjected to acids which would attack the aggregate of which the concrete is composed more than they would vitrified pipe or brick, there is no reason why well-constructed cement sewer pipe should not last as long as vitrified pipe. There are good and poor grades of cement pipe, as well as of clay pipe and comparisons should be made of similar grades.

The cement pipes can be made more uniform in surface and shape, so that neat joints are always possible. This offsets the greater smoothness of the salt-glazed clay pipe surface. If a richer mortar is used on the inside of the cement pipe the surface can be made as smooth as may be desired.

MERITS OF HOLLOW CONCRETE BLOCKS.

I am contemplating the manufacture of hollow concrete blocks and would like your opinion of this product. I should also be pleased to correspond with manufacturers of machinery for making these hollow concrete blocks and also cement sewer pipe. O. H. C., ——, N. C.

Nearly every number of Municipal Engineering for the past three years contains some information about hollow concrete blocks and there are many expressions of opinion regarding the new building material, all of which are very favorable to blocks well designed and well made of good materials. Reference may be made to leading articles and editorials upon concrete block manufacture and construction and the architectural features of concrete block construction in the numbers of the past year for discussions of some of the difficulties met with and the methods of avoiding them. Titles of some of these articles are "Incompetence in Building Construction," vol. xxvi, p. 239; "Concrete Block Architecture," vol. xxvi, p. 313; "Concrete Block Manufacture," vol. xxvi, p. 389; "The Architect and Concrete Construction," vol. xxvii, p. 16; "The Demand for High Class Construction with Cement Blocks," vol. xxvii, p. 106.

For information about makers of concrete block machines and molds reference should be made to the "Business Directory," published in each number of Municipal Engineering under the headings "Cement Construction," "Cement Machinery," "Cement Pipes Molding Press," "Cement Posts," "Cement Sewer Pipe Machinery," "Concrete Blocks," "Concrete Work." The advertising pages contain more or less complete descriptions and illustrations of the block machines of all the leading manufacturers. Reference may also be made to the list of hollow concrete block machines in the "Directory of American Cement Industries" ($5).

These subjects will be fully discussed in the convention of cement users to be held in Indianapolis, Ind., Jan. 17, 18 and 19, 1905.

COLLAPSIBLE CENTERING FOR CONCRETE SEWERS.

I have in mind a project whereby a continuous sewer may be built with concrete. My object is to make a core that will collapse and draw easily so that the sewer can be built on continuous as far as desired, leaving a perfect, smooth sewer. I would like to know if there is not already a patent that covers my idea.
J. G., Grand Island, Neb.

There are several varieties of collapsible forms for brick and concrete sewers. One of the latest is Muehle's, which is described elsewhere in this number of Municipal Engineering in an article entitled "Collapsible Centering." Our readers who have devices of their own for this purpose may be willing to describe them for Municipal Engineering.

REMOVING BOLTS FROM CONCRETE.

We have some parties here who want us to construct them a set of steam boxes for the purpose of steaming stave bolts out of concrete and before attempting to do so we would like to inquire if you know of any one who has had experience in this, as we are not sure it would be a success. C. & J.
Hicksville, O.

If the concrete is made with Portland or hydraulic cement it is not probable that the steaming would have any material effect in separating the concrete from the bolts. The only ways of removing bolts or rods from concrete known to the writer are to drive the

bolts out of the concrete after removing nuts, if they have been used, or, if the concrete is refuse from a demolished structure, to break up the concrete. It is sometimes not difficult to separate a smooth, straight bolt or rod from concrete if it projects through the concrete and can be driven by repeated blows with a hammer or sledge. A slight skim of neat cement may remain on the rod, but even this can be nearly all scaled off by hammering and scraping.

Will our readers give us reports of their experience in this line?

CEMENT BAGS AND MACHINERY FOR MAKING THEM.

If you have anything on cement bags I would like to know it, especially prices on cement bags at present and machinery for making bags and printing them, price of cotton duck used in the same, etc.

G. D. S., Phillipsburg, N. J.

The price of the bags depends on the amount of material used in them and exact quotations will not be made by the mills without full information as to exactly what is wanted. Such companies as the Bemis Bro. Bag Company of Indianapolis and seven other cities make cement bags of cotton, burlaps and paper and will give quotations on receipt of data. The Standard Machine Works, Newark, N. J., and Wicks Bros., Saginaw, Mich., are reported as manufacturing bag making machinery.

COST OF MAKING AND LAYING CEMENT BLOCK.

We have organized a company for the purpose of cement construction work and have included cement hollow block, and we are now putting up a building three stories high, of hollow blocks made 8 inches thick, 12 inches wide and 24 inches long, that is the most of the blocks in the building are of this size. We are very dissatisfied and disappointed in the cost of these blocks, cost of making, and in particular the cost of laying them in the wall. These blocks are costing us about 15 cents apiece to lay them in the wall. This, together with the cost of making the blocks, makes the building cost much more than brick. We would like to hear from others that are in the hollow block business in regard to their cost of making the blocks, and in particular the cost of laying them in the building. Any information you can give us along this line will be highly appreciated.

A. T. B., Monett, Mo.

This inquiry is referred to our readers and statements of actual cost of manufacture and of laying blocks in the walls for an entire building are requested. Names will not be published except by express permission. The question will also be presented to the convention of cement users, to be held in Indianapolis, Jan. 17, 18 and 19, 1905.

BOOK ON CEMENT BUILDING BLOCK MANUFACTURE.

I would be pleased to have reference to some good work on cement building block manufacture.

E. T. B., Mullinville, Kan.

But one book upon this subject has appeared, Hagloch's "Art Stone" ($1). The best source of information is Municipal Engineering. Nearly every number since January, 1902, has contained one or more articles of direct value to the maker of cement building blocks. Illustrated descriptions of all the prominent machines and processes have appeared in the magazine and pictures of nearly all the machines and of buildings constructed of the various styles of blocks will be found in the advertising pages.

HOW TO CONSTRUCT HOLLOW SPACES IN CONCRETE WALLS.

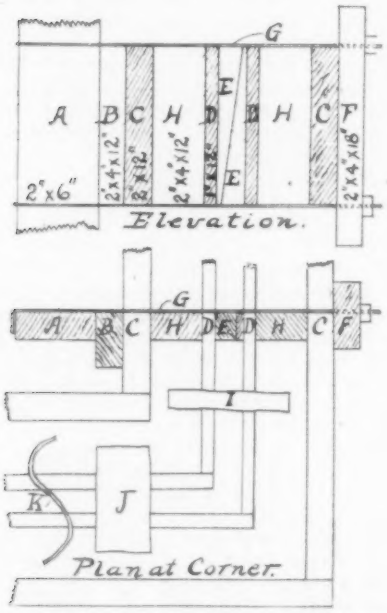
The following has been received from John Grabach, Grand Island, Neb., as an answer to the inquiry of A. A., in Municipal Engineering, vol. xxvii, p. 430, for methods of constructing hollow spaces in plain concrete walls. We trust that his action will prompt others who have different methods to send us descriptions of them for publication. Mr. Grabach claims that the wall which he constructs according to this method is "superior to any cement block wall ever made and much cheaper. It can be formed in rock faced ashlar or cut stone with sunk joints or brick face, or, in fact, any design that blocks can be made to imitate."

Lay out the building, draw all lines on the outside, and dig trenches and cellar. Do the foundation work ready for the joists of the first floor with either hollow or solid walls.

Then, if the walls are to be built from outside, set 2 by 6 risers, A in the diagram, 4 inches from the inside line of the wall about 4 inches from the inside angles. Then divide up the spaces between angles or corners and place the risers from 4 to 6 feet apart along the entire length of the walls. Supply an iron bolt for each riser, bent to form a rectangular hook to hook round the riser at one end, and furnished with thread and nut at the other end. These bolts, G in the diagram, must be 28 inches long if the walls are 12 inches

thick. The bolts pass between the planks forming inside and outside of cement molds and serve as supports for the planks in the next course above them. They pass through holes bored in the pieces, F, described below.

When the bottom bolts are put in place



FORM FOR HOLLOW CONCRETE WALL.

A—2 by 6-inch riser.

B—2 by 4-inch key, 12 inches long.

C—2 by 12-inch planks, outside faces of forms.

D—1 by 12-inch planks, inside faces of forms.

E—Wedge blocks, together fixing width of hollow.

F—End piece, 18 inches long and about 2 by 4 inches in section through which bolts G pass, and which serves as straining piece in screwing up nuts.

G—Bolts about 28 inches long, hooked about risers, A, passing between planks C in adjacent courses; also between planks, D, in adjacent courses, and through holes in F, serving to hold forms together.

H—Blocks to hold planks C and D apart until concrete is filled in. Removed as filling proceeds.

I—Hoop-iron tie.

J—Brick used as tie.

K—Wire tie bent in form of S.

hooked round the riser on the inside of the wall, place the 2 by 12 plank C on the inside with a key, B, between it and the riser. This key is made of 2 by 4 stuff and is as long as the plank is wide, 12 inches.

Then place two 1 by 12 boards, D in the diagram, and place between them the keys, E in the diagram. These keys are the same length as the width of the plank, 4 inches and are wedge shaped and placed one thick end up and the other thick end down. They keep the two one-inch boards apart to form the hollow in the middle of the wall and will together have a thickness of 2 inches if the hollow in the wall is to be 4 inches across. Then place the outside 2-inch plank, C. The block F is about 18 inches long and has two holes bored for two bolts G at bottom and top of the course. This block is put in place outside the outer plank and the bolts are passed through it. Filling pieces, H, which are 2 by 4 blocks are put in between the planks C and D to hold them apart to receive the concrete. They are drawn out as the concrete is filled in. When these fillers are in place all the bolts in both rows are screwed up until there is exactly 12 inches between the inside and outside mold planks, C. The wedge shaped keys E give chance for exact adjustment. The molds are now ready for filling in the concrete.

It is the best plan to have all the boxing done for a course around the whole building before commencing to fill in, unless there are hands enough to keep up with the concrete making and filling.

When the first course is set sufficiently to stand, proceed to construct the next higher course.

In taking down the mold the keys, E, in the middle are drawn first. Then the bolts are unscrewed, the bottom bolts are driven flush with the inside surface and then pulled out, and the bolt holes are filled with cement mortar. The walls should be trimmed while green.

Before beginning the next course place anchors over the hollow in the course below. Any kind of iron will do, old barrel hoops, such as I in the diagram, if heavy enough, or heavy wire bent S-shape such as K in the diagram, or even brick may be used, as J in the diagram. If brick are used the middle board, D, must be notched on the bottom to fit over thm.

For this work I make my mortar 1 part cement, 3 parts sand and 3 parts crushed rock for the outside and 1 cement, 4 sand, 4 crushed rock for the inside. Coarse gravel may be used instead of rock.

If the filling is done from the inside the risers are set on the outside of the wall. It may be well to say that joists are placed on the foundation and the risers, if on the inside, are nailed to them. Of course, a full length plank cannot be used on the inside between

joists, so short boards are nailed on, which may be left on or taken off when tthe wall is joist high.

Place door frames and a jamb to inside and outside wall lines with arch. Place window frames in the same way when the walls are window high.

ALKALI WATER FOR MIXING CONCRETE.

Please let us know just what effect alkali water has upon cement when it is used in forming the mortar.

H. J., Lake City, Iowa.

This is a question for a chemist or to be determined by trial. The chemical composition of the cement, the character and amount of the alkali in the water and even the chemical nature of the other materials in the concrete are important factors, so that a general answer cannot be given safely. There may be no objectionable effect, the setting of the cement may be hastened or retarded or prevented, the concrete may swell and thus disintegrate, it may have a harmful or a harmless efflorescence on the surface according to the character and amount of the alkali present and whether the constituents of the cement may be affected thereby. The only methods of getting correct answer to the question are analysis by expert cement chemist and test in actual use, continued long enough to show the full chemical action.

In Municipal Engineering, vol. xxvii, p. 117, will be found a complaint of trouble with cement walks made of sand containing considerable alkali. The amount carried in alkaline water is probably much less than that found in this sand and it would therefore be less objectionable.

RATIO OF TENSILE AND CRUSHING STRENGTHS OF CONCRETE.

What is the approximate ratio of crushing strength of concrete to the tensile strength? In other words, if we find the tensile strength of a briquette to be 300 pounds what could we safely infer to be the crushing strength of the same briquette?

FRANK T. CLARK, Ft. Dodge, Iowa.

The general statement of the ratio mentioned is that the crushing strength of concrete is 8 to 10 times its tensile strength, but this statement is very general, and it would not be safe to reverse it, for the tensile strength of a sample might easily be less than one-tenth its known crushing strength. There is considerable variation in the results of tests of tensile strength, especially with the leaner mortars, single results varying 20 or 25 per cent from each other, so that the general statement may not exactly fit a particular case. Again, there are very few, if any, reliable results of tests of the tensile strength of concretes, the methods used in testing cement mortars being obviously not applicable to concrete made with fragments of stone as large as the ordinary briquette.

The reliability of the statement made can readily be tested for cement mortars, and it is likely that the averages of a series of results will not vary greatly therefrom whatever single results may do. It is also probable that the ratio of the crushing strength of concrete made of mortar and crushed stone or gravel to its tensile strength is greater than that stated. An additional reason for this last statement is that concrete under compression is in a large mass which helps to support itself if it is not buried in other material having some supporting action, while a sample under tension is dependent on its weakest spot alone. The increase in compressive strength per square inch with increase in dimensions of test sample is shown in comparing, for example, the results of tests on 2, 6 and 12-inch cubes. Very few such tests have been made of concrete, but enough to show that it follows the same rule as stone in this respect.

CEMENT BRICK AND SAND-LIME BRICK.

Will you be so kind as to give me your valued opinion of cement brick and also of sand-lime brick, stating whether you would accept either in preference to ordinary clay brick and if so at about what difference in price?

S. N. PETERS, Greensboro, N. C.

Both these classes of brick can be made cheaply and to compete in appearance and durability for ordinary uses with clay brick. Common clay building brick will absorb perhaps as much as 20 per cent of water and, according to quality of material and mode of manufacture the density of the brick can be increased so that the absorption of water will not be more than, say, 2 per cent. The same results can be obtained with cement brick by using greater or less proportions of cement and greater or less care in manufacture. All grades of cement brick in appearance, absorption and durability can be made just as all grades of clay brick can be made.

The same is true to a certain extent of sand-lime brick.

It is probable that cement and sand-lime brick can be made cheaper than clay brick of similar quality and beauty of form and face, but this depends upon local conditions as to cost of materials and labor for the respective kinds, etc.

This means that the market is open to all three classes of material on terms which vary with the locality. Choice must therefore be made in any locality with reference to its particular conditions as to price, quality of bricks offered, appearance, color, adaptability to the desired use, conditions of delivery, etc., as well as individual preference

The expertness of the manufacturers ordinarily has quite as much to do with the relative value of the bricks and their relative cost as the quality of materials of which they are made.

Reference may be made to the following articles in Municipal Engineering for information about cement brick and sand-lime brick.

In vol. xxvii, "Steam for Hardening Cement and Lime Mixtures," p. 436; "Sand Cement Brick," p. 461; "Crushing Strength of Concrete Blocks, Sand-Lime Brick, etc.," p. 371; "The Sand-Lime Brick Industry," p. 387; "Extension of Use of Sand-Lime Brick," p. 312; "Sand-Lime Brick Factory at Wilmington, Del., p. 139.

In vol. xxvi, "Brick of Cement and Sand," p. 414; "Cement Paving Brick," p. 275; "The Brick of the Future," p. 4; "Cement Brick for Chimney," p. 413; "Makers of Sand and Cement Brick," p. 241; "Strength of Cement and Sand Bricks," p. 426; "Strength of Sand-Lime Bricks," p. 426.

In vol. xxv, "Sand Bricks in France," p. 454; "Calcareous Brick and Stone Manufacture in Germany," p. 454; "A Sand-Lime Brick Plant Under the Huennekes System," p. 461; "Cement Brick," p. 175; Manufacture and Strength of Sand-Lime Brick," p. 240; "Information about Sand Brick," p. 249; "Buildings of Sand Brick," p. 288; "Sand or Sand-Lime Brick," p. 27

In vol. xxiv, "Brick of Cement and Sand," p. 192; "Sand Brick," pp. 218, 457.

Other articles will be found in earlier volumes.

HORSE POWER OF WATER UNDER PRESSURE.

Will you please inform us what quantity of water will be required to develop one horse power with a pressure of 110 pounds? We desire to use a 15-horse power motor. W. B. C. & CO.,
Louisa, Ky.

The gross horse power of water is equal to the weight of water flowing in one minute multiplied by the distance it falls and divided by 33,000. A pressure of 110 pounds corresponds to a fall of a little more than 250 feet. As water weighs about 62.5 pounds a cubic foot, this requires about 2.15 cubic feet a minute to generate one horse power at 110 pounds pressure. Practically the net horse power developed by a water engine must be discounted from 15 to 65 per cent under ordinary conditions, so that say 2.5 to 6 cubic feet a minute will probably be necessary to deliver one horse power on the shaft. A table of the properties of the Pelton water wheels, which assumes an efficiency of 85 per cent, indicates that a 6-inch wheel at 250 pounds pressure would develop about 2.38 horse power and use about 5.92 cubic feet of water; also that an 18-inch wheel would develop 16.69 horse power and use 41.45 cubic feet of water, or in each case nearly 2.5 cubic feet of water per horse power developed. Small wheels, wheels not run at their rated capacity, and wheels on low heads may deliver much less than the 85 per cent of the total horse power in the water which is assumed above.

APPARATUS FOR THAWING HYDRANTS—BOOKS ON STREET PAVEMENTS AND ELECTRIC LIGHTING.

Can you give me the address of any maker of portable hand apparatus for thawing hydrants and water services?

Can you recommend some good up-to-date work on electric lighting and also a good late work on street pavements that will include bitulithic and all new pavements? W. H. S., Brandon, Man.

The first question is referred to our readers. In a discussion by the New England Water Works Association of the subject of thawing service pipes, it was brought out that the apparatus in most common use consists of a small boiler and a small hose capable of carrying steam from the boiler to the hydrant or service to be thawed. A small boiler which can be hauled by hand or with one horse is sufficient for thawing hydrants. The fuel may be oil, coke or coal, the weight to be hauled increasing in the order named. If steam is used for thawing the ground down to the frozen service a larger boiler is necessary. One member reported the successful use of quick lime, the lumps of lime being laid on the ground, wet with water and covered to retain the heat. The thawed

earth being excavacated the process could be repeated if necessary. This process has the advantage of leaving the thawed earth comparatively dry and thus removes the danger of immediate freezing of the ground or pipe. This method should be equally well applicable to thawing hydrants. Names of any manufactures of apparatus intended specially for this purpose will be published if our readers will send them to us for this purpose.

The standard books on electric street lighting are the following:

Crocker's "Electric Lighting," in two volumes, the first devoted to the generating plant and the second to the distributing system and lamps. Each volume costs $3.

Foster's "Electrical Engineers' Pocket Book" ($5), covering the entire electrical engineering field.

There are many books on special parts of the field and on details, such as Wiener's "Dynamo Electric Machines."

Baker's "Roads and Pavements" ($), is the latest American book on the subject and is late enough to contain some mention of bitulithic and some description of modern creosoted block pavements, though not late enough to give full reports of the tests of these materials in practical use. The volumes of Muncipal Engineering Magazine are the best source of information about the new paving materials, and many articles descriptive of them will be found in each volume. The series of articles on bitulithic pavement, specially mentioned by our correspondent, began in vol. xx, p. 262. There were several articles on tar macadam in earlier numbers of vols. xix and xx.

A PROBLEM IN ELECTRIC LIGHTING.

We have here at Roland Park, in connection with our suburban development, an electric light and water plant. Our electric lighting system is direct current, 3-wire, 220-volt across outside wires and 110-volt across neutral and outside wires. We are experiencing the usual trouble of grounds in a system of this kind. We also experience trouble from the fact that our neutral wires, while large enough under ordinary conditions, at times when the load is unbalanced, seem to be too small to keep the voltage up to standard when the load is at its peak. In order to overcome the trouble of grounds, we have thought of grounding our neutral in various places to our water mains, in order to burn off the small grounds that occur and to equalize the load on the neutral wire at times when the load is heavy and unbalanced, by using the water pipes as balancing conductors. Our load from 6 to 10 o'clock in the winter will average about 1,400 amp., and for the rest of the twenty-four hours about 500 amp. We should like to know from a standpoint of safety, or fire insurance, if it is unadvisable to ground the neutral; if the neutral is grounded to the water mains, will this assist in equalizing the load on these wires, and would there be any danger of electrolysis under such voltage and volume of current? Further, will this arrangement affect the economy of the operation of the plant? The sizes of our water mains are 4, 6 and 10 inches.

ROLAND PARK COMPANY.
Roland Park, Md.

Mr. H. B. Marsh, consulting electrical engineer, Indianapolis, says in reply to this question that in general this method of grounding the neutral wire will be found to work satisfactorily. It will be necessary to ascertain some local conditions before it can be determined whether the troubles will all be overcome, such as size of wires, relative proportion of light and power in the load, etc. These can best be determined by an engineer who has an opportunity to make a personal inspection of the plant and a study of its operation.

ELECTRIC STAND-PIPE VALVE

Is there a valve on the market by which water can be turned on and off at a stand-pipe at some distance from the pumphouse, without going to the valve?

D. W. J., ———, Ind.

The Engberg valve is operated by electricity. It is an ordinary gate valve with a controlling device operated by electricity over a one or two-wire circuit to a switchboard at the pumping station. A gong on the switchboard rings when the valve begins to move and again when the motion is finished, two strokes indicating that the valve is open and one that it is closed. The gong also announces any tampering with the valve itself, or any accidental opening or closing.

DESCRIPTIONS OF WATER WORKS PLANTS.

Kindly advise me where a publication descriptive of water works plants of different cities arranged by States can be obtained, as I presume there is a directory of this sort published.

H. VON SCHON, Detroit, Mich.

The "Manual of American Water Works" ($3) is the publication desired. The last edition of this book gives the details in condensed form. Earlier editions contain illustrated descriptions of many

details of water works construction, and it would require reference to several of the volumes to secure all the data published in the various editions of the book.

BOOKS ON MECHANICAL ENGINEERING AND BUILDING.

Will you have the kindness to give me a list of books on mechanical engineering, particularly as applied to designing of mill machinery, gearing, pulleys, belts, etc.?

Can you at the same time give me any information on estimating cost of buildings by cubic contents thereof?

SUBSCRIBER, Quebec, Canada.

Suplee's "Mechanical Engineers' Reference Book" ($5) devotes a few pages to brief but detailed information on machine design, including particularly the subjects mentioned.

Halliday's "Notes on Belt Driving" ($1.50) describes the different kinds of belts, pulleys and rope gearing in use and gives tables and formulae.

Klein's "Machine Design" ($6) gives the elements of machine design with notes and plates for the use of students in design.

Box's "Mill Work" ($3) is an English work described as a practical treatise on mill-gearing, wheels, shafts, riggers, etc., for the use of engineers.

Cromwell's "Treatise on Toothed Gearing" ($1.50) contains complete instructions for designing, drawing and constructing all kinds of gear wheels and apparatus.

Cromwell's "Treatise on Belts and Pulleys" ($1.50) describes the various kinds of belts and gives rules for designing them and the pulleys for them. It also takes up the subject of rope gearing and metallic cables.

Flather's "Rope Driving" ($2) is a treatise on the transmission of power by means of fibrous ropes.

Jones's "Machine Design" is in two parts, the "Kinematics of Machinery ($1.50) giving the general principles and methods of power transmission in machines, and the "Form, Strength and Proportions of Parts" ($3) going into details of design and construction.

MacCord's "Kinematics" ($5) is a treatise on the transmission and modification of motion and the construction of mechanical movements.

Herrmann's revision of Weisbach's work, translated by Klein, is in two parts, "Kinematics and the Power of Transmission" ($5) and "Machinery of Transmission and Governors" ($5) similar in division to Jones's book mentioned above.

Rankin's "Machinery and Mill Work" ($5) is the classic in this line.

Van Nostrand's catalogue of books on steam engines, machinery, mechanics and mechanical engineering contains a number of additional titles of books upon this subject, most of them of earlier issue, and most of them published in England.

Kidder's "Architects' and Builders' Pocketbook" ($4) in its latest issue gives methods and rules for computing cost of buildings per cubic foot of included space and many examples of actual cost of buildings of many kinds as constructed.

Municipal Engineering Company can send any books mentioned on receipt of the list price.

MUNICIPAL MATTERS IN COURT

Higher Courts—Louisville Water Plant—Bay State Gas—Public Improvements in Illinois Cities—Street Railway Paving—Payment for Paving from General Fund.

Abstracts from Decisions by the Higher Courts on Matters of Interest to Municipalities.

Prepared by H. R. Sullivan, Indianapolis, Ind.

When Board of Local Improvement is Personally Liable—The members of a board of local improvements are personally liable in damages to a property-owner who has been assessed for the improvement of a street, when the members of the board corruptly allow the contractor to substitute and use material inferior to that required by the specifications of the contract. Gage vs. Springer et al., 71 N. E. Rep. (Ill.), 869.

Insufficient Assessment—Where a special assessment for the improvement of a street has been confirmed by a jury in a trial of the question of benefits and a verdict returned that the property was assessed the precise amount which it was specially benefited, the amount of the assessment has been determined and the assessment cannot be subsequently increased on the ground that the former assessment was insufficient to pay for the improvement. Town of Cicero vs. Green et al. N. E. Rep. (Ill.), 884.

When Second Assessment Is Valid Without an Ordinance—In case the first assessment for a public improvement proves insufficient the board of local public improvements may fix the second assessment upon the estimate of the engineer, and a public hearing and second ordinance are unnecessary to the validity of the second assessment. City of Chicago vs. Noonan et al., 71 N. E. Rep. (Ill.), 32.

Illinois Law Regarding Public Contracts—In Illinois all public works or improvements which exceed $500 must be let to the lowest responsible bidder unless such contract is awarded by a two-thirds vote of all the aldermen or trustees elected. City of Chicago vs. Hanreddy. 71 N. E. Rep. (Ill.), 834.

Personal Injuries Resulting from Defective Streets—The city of Muncie lowered the grade of an avenue where it crossed a street, but left the sidewalk at its original grade, making a steep incline from the street to the sidewalk. By constant travel a pathway was formed leading from the grade of the street to the grade of the avenue. Plaintiff while passing over this pathway slipped and was injured. It was held that this was such a negligent failure on the part of the city to keep its streets in proper repair as to render it liable in damages to plaintiff. City of Muncie vs. Spence, 71 N. E. Rep. (Ind. App.), 907.

Obstructions in Streets and Sidewalk—Where the concrete sidewalk of a street extended partly across an intersecting street which had no sidewalk and on one side of the projection of the concrete walk stones had been placed to hold the walk in position, the top of the stones being about six inches above the soil and even with the line of the concrete walk, it was held that the stones did not amount to an obstruction, so as to render the city liable for injuries received by one who stumbled over them. Burke vs City of Haverhill, 71 N. E. Rep. (Mass.), 256.

Property Owner Not Personally Liable for Street Improvements—The property owner is not personally liable for an assessment to pay for a street improvement. The assessment can only be collected off of the property assessed. Orth et al. vs. R. B. Park & Co., 81 S. W. Rep. (Ky.), 251.

Time In Which Public Contract Must Be Completed—Where a definite time for the completion of a street improvement is specified in the ordinance ordering it, or if no time is specified, but time is made the essence of the contract, tax bills under the ordinance will be void if the work is not completed within the time specified, but where the ordinance fixes no time for the completion of the

work and the contract does not make times the essence thereof, the improvement is required to be completed only within a reasonable time. Hilgert vs. Barber Asphalt Co., 81 S. W. Rep. (Mo. App.), 496.

What Constitutes Sufficient Publication of an Ordinance—Where an ordinance for a municipal improvement requires the city engineer to advertise five days for bids and such advertisement is made for five days, although not consecutively, the advertisement is sufficient to constitute a legal publication. Roth vs. Forsee, 81 S. W. Rep (Mo. App.), 913.

A Macadam Street Is a Paved Street—It is held in Missouri that where a ordinance provides a street should be paved and it is macadamized, the ordinance has been complied with. Ross vs. Kendall, 81 S. W. Rep. (Mo. Sup.), 1,107.

Petition Not Necessary Before a Street Is Graded—In Kansas the Mayor and Council of a city of less than 25,000 inhabitants have the power to contract for the grading of streets and alleys and to levy a special assessment upon the abutting property to pay for the improvement without a petition for said improvement having been first signed and presented by the resident owners of abutting property. Tarman et al. vs. City of Atchison et al., 77 Pac. Rep. (Kansas Sup.) 111.

Street Improvement Lien Ahead of Mortgage—A lien for street improvement is a lien upon the property and is paramount and prior to the lien of a mortgage on the same property. O'Dea vs. Mitchell et al., 77 Pac. Rep. (Cal. Sup.) 1,020.

Failure to Object Is Fatal—Where a property-owner fails to appear and object to a reassessment of his property for streets improvements after proper notice is given he thereby waives the question of excessive amount of the reassessment. Alexander vs. City of Tacoma, 77 Pac. Rep. (Wash. Sup.) 686.

Why Should Louisville Water Plant Pay Taxes.

The Louisville Water Company, Louisville, Ky., entered protest against the assessment made by the City Assessor, Dec. 14, objecting to the payment of city taxes on its property and franchise. The Assessor placed a valuation of $4,450,000 against the company's property. The city board, which has charge of the complaint, will not take it up until after the decision of the court of appeals on the question of the liability of the water company for city taxes. The court decided that the company must pay city taxes, but could recover from the city a rebate for the value of the water used by the city for a number of years. The city attorney, Henry L. Stone, asked the court to amend this ruling and hand down a decision holding that the water company is liable for taxes, but that the city does not have to pay for the water used. The amended prayer is now before the court and a decision is expected shortly. This is the decision awaited by the Board of Equilization, and after it has been handed down the board will take up the question of reduction or increase of the figures which have been fixed by the Assessor.

Disposition of Bay State Gas Stocks.

The terms of settlement of the case of George Wharton Pepper, receiver of the Bay State Gas Company, against J. Edward Addicks and other officers of the company for an accounting of stock issued by them, provide that Mr. Addicks and the directors of the company return to Receiver Pepper 1,021,250 shares of the 1,500,000 shares, with a par value of $75,000,000, which were alleged to have been issued unlawfully. For the remaining 478,750 shares the defendants are to pay the receiver $48,254.52, which is the amount realized by the defendants from the sale of the stock in the open market. This payment in sixty days is secured to the receiver by a bond signed by Mr. Addicks and others.

Decision Affecting Public Improvements in Illinois Cities.

The Illinois Supreme Court has rendered a decision declaring invalid the act of 1903, which provides that in cities under a certain population pavements may be constructed without petition from the abutting property-owners. In 1903 the Legislature amended section 4 of the local improvement act so as to abolish the necessity of a petition of property-owners for an improvement to be paid for by special assessment in cities having less than 20,000 inhabitants, but requiring a petition signed by one-half of the owners of abutting property where the city is above 20,000. The court holds that this is contrary to the constitution of 1870, which provides that cities, towns and villages shall not be classified for the purpose of taxation. The amendment of 1899, which requires a property-owners' petition as the basis of an ordinance for a local improvement to be paid for by special as-

sessment is held to be in force at the present time. It is believed that when the general assembly meets in December that portion of the law held unconstitutional will be amended to conform to the constitution of the State. The decision was rendered in the case of L'Hote vs. the village of Milford.

The decision leaves a large number of cities and towns in doubt as to the validity of the ordinances under which they are working, some of which are as follows:

Rock Island—Ordered improvement of fourteenth-ave.; assessment roll included names of majority of property owners and was confirmed in County Court after fight on part of objectors, several of whom filed bond to carry case to higher courts; ruling of Supreme Court makes hearing of appeal unnecessary, and annuls ordinance ordering improvement. Will delay proposed drainage system for southwestern part of city.

Belleville—Under law of 1903 street improvement ordinance was passed, subject to approval of County Court; street improvements were started and city now has $150,000 in completed brick streets and sewers; city now has under construction about $100,000 worth of work and contracts are to be let soon for about $50,000 more, making a total of $300,000, on Belleville streets as a result of the passage of this law.

Sterling—Paving of W. Fourth-st. and Avenue B and all paving constructed this year was under this law; what effect the decision will have on local work is not known. Contractors state that they will continue the work of paving until further notice is given; firm has already disposed of bonds for other paving improvements without recourse, so it is thus far protected.

Normal—Improvements affected are pavements on Main, Sill, Broadway and North-sts., and ordinances for water mains on University-st. and Hovey-ave. and a sewer on Beaufort-st. Council has pushed ordinances along, supposing the law under which they were working to be valid, but will now drop them, and when taken up again it will be by petitions of a majority of the property owners affected. While it gives the improvement question a setback, it will not be long, for the town is ripe for pavement.

Gibson City—City authorities have already incurred a great deal of expense for proposed paving without a petition and it is doubtful if one can be obtained.

Paxton—City authorities required a petition signed by a majority of property owners before attempting to pave, so that the pavement now being constructed will not be affected by the decision of the Supreme Court.

Taylorville—P. H. Hunt & Co. of Decatur have constructed about $100,000 worth of paving in this town, for which they have received about $50,000 in cash, the remainder having been given then in the shape of bonds that are not yet sold. Work was completed and accepted by town and settlement was made by turning over cash and bonds. Question now arises as to how Hunt & Co. are to get the $50,000 due them on the work. Contract was to have been let in a short time for paving 35 blocks more of streets.

Lincoln—Street paving contracts are null and void unless the contractor will take the chances of doing the work and depending upon individuals to pay him. The decision had been expected for several months and quite a number of lawyers consulted had expressed themselves as being of the opinion that the law was unconstitutional; contracts will probably be canceled unless consent of property owners is obtained, which is doubtful.

As the matter now stands the bonds issued for recent paving in Dwight, Streator and a number of other places are illegal, and will not have to be paid. There is said to be no great inclination, however, in any city to take advantage of the decision and get something for nothing. The delay that it will cause in further improvements seems to give more concern than anything else.

Burlington, Ia., Can Pay for Paving from General Fund.

The supreme court of Iowa has rendered an opinion affirming the decision of Judge Withrow regarding the improvement of Columbia-st., in Burlington. The improvement of Columbia-st. was nearly completed and the property-owners had paid for the cement curb and gutter according to their agreement, when this suit was begun. In 1898 the city proposed a plan for the improvement of this street, which was objectionable to the property-owners, in that it involved cutting down the entire surface of the street and lowering the sidewalk grade in such manner as to greatly damage and injure them. The plan under which the street was

finally improved was the result of a compromise, and provided for the flattening of the transverse line of the street, the narrowing of the macadamized portion to an average of about 32 feet; the widening of the parking to an average of about 23 feet, with no disturbance of the sidewalks or the surface of the ground at the lot lines, and no interference with the means of ingress or egress to the properties on the north side of the street. It is claimed that the plaintiff assented to these plans. He brought this action to restrain the city from paying any part of the cost of the improvement out or the general funds of the city. He did not own any property on Columbia-st., nor does it appear that he was ever especially assessed for street improvements in front of his property. The case was tried in the lower court before the plaintiff's death, and on the witness stand he practically conceded that he had no objection whatever to the manner of the improvement of Columbia-st., but that he did object to the city's paying for it out of the general fund. It was argued, however, that the matter of damage to these property-owners should have been submited to a tribunal selected in the manner pointed out by statute for appraising such awards. The court points out that there are several answers to this, as follows:

First. There is no need for such a tribunal when the parties in good faith agree on the amount to be paid. The City Council, as we have said, represents each and every taxpayer in these matters. The individual taxpayer could not intervene in such a controversy if he would. Doubtless court would intervene to prevent fraud or gross mismanagement, but nothing of that kind is charged or shown.

Second. These owners were not allowed any damages. They were relieved of special assessments, it is true, for the new macadam which was to be used and the expense of laying the same; but as they had once, and probably twice, paid for the improvement of the street, there was no inequity in this. Moreover, the entire improvement was made pursuant to a valid agreement between the city officials and the property-owners for the purpose of getting as good a street as possible with as little damage to the property-owners as the circumstances would warrant. Mr. Crapo agreed to these plans, saw the work going on and made no objection until he found that the cost was to be paid out of the general funds. This was his sole complaint, and although he knew of the agreement with the property-owners, he kept his own counsel until after the work was nearly completed.

Appellant's argument, carried to its logical end, would tie the hands of the legislature for all time. That is to say, having adopted the theory of special assessments, it could never depart therefrom; and, vice versa, if it authorized payment for street improvements out of the general city funds, it could never resort to special assessments. This, of course, cannot be the law. We need not determine whether a city council is bound by an election once made by it under the statutes, for that question does not arise here, there being no facts upon which to base any such proposition.

There is no evidence that the property owners were paid any damages. They simply waived all claims thereto, and the city undertook to improve the street, and to pay for it out of the general funds This it clearly had a right to do.

Rochester Street Railway Not Obliged to Pay for Paving Tracks.

The appellate division handed down a decision Nov. 15 in the case of the city of Rochester, N. Y. against the Rochester Railway Company, affirming Justice Nash's ruling that the municipality cannot collect from the company for the paving between and alongside street car tracks. The case will probably be carried to the court of appeals.

Washington Supply Contracts.

A question of special interest to persons holding contracts with the District of Columbia to supply various articles for the use of the municipality during the year has been decided by District Commissioner West, who holds that a contractor bidding on a certain specified amount of supplies estimated by the Commissioners as required by the District for a certain period of time, is bound by the terms of his contract to furnish, upon application, a greater or a less amount than that specified as the wants of the District may require.

Commissioner West recommends further that in the event of the contractors' failure to supply the articles asked for by the District, these supplies shall be purchased in the open market and the expense charged to the contractors according to the terms of the contract.

STREETS AND PAVEMENTS

Chicago Streets—Sacrifice of Trees—Municipal Street Sweeping—New Jersey Brick.

Condition of Chicago Streets.

On Dec. 1 M. J. Doherty, Chicago's superintendent of streets, presented a report upon the need for repairs, which is based on a careful survey of all the city's pavements. The fact that the appropriations for street repairs have been less than $100,000 a year for the past four years, aggregating $189,765 for that period, is sufficient reason for the present conditions.

Mr. Doherty bases his estimates on the following prices:

For asphalt, where concrete is used, $2.50; for top, $1.50; for repairs on brick where concrete is used, $2.50; for granite, $1.50; for cedar block, 80c. I have based the price of repairs on asphalt on bids that have been received by this department during the last two years. On macadam I have based the price at $1.80 per cubic yard. A cubic yard of macadam rolled to a depth of three inches would make about nine square yards of repair. The cost to this department for macadam delivered on streets within the city is $1.65 per square yard. I have added the other 15 cents for spreading same. In connection with macadam repairs I wish to state that when the plant at the House of Correction is in full operation, we can cheapen the cost of same a great deal, but in order to make a good repair rolling and spreading must be done and this will necessitate the use of a steam roller, which will bring the price up to the amount I specify.

In connection with repairs on brick, I wish to state that we have a number of brick streets out of reserve which are in need of immediate repair.

The price on granite is $1.50 per square yard, which would seem exorbitant, but when it is considered that all granite repairs will need at least a foundation of three inches of macadam, it is, in my estimation, not excessive.

The cost of cedar block pavement repairs, I estimate at 80c per square yard, and as, in a good many instances, new five-inch blocks will have to be bought in order to complete the repair, and as the cost of cedar blocks has gone up in the past few years, I do not consider this item at all excessive.

I further wish to state that the total amount of repairs necessary to be done, as the reports show, amounts to over a million dollars and I have asked this year in my appropriation for only a little more than 10 per cent, knowing the financial condition of the city, and I would ask that you recommend to the finance committee their favorable consideration of the following:

For the repair of asphalt	$ 60,000 00
For the repair of macadam	35 000 00
For the repair of brick	5,000 00
For the repair of cedar block	15,000 00
For the repair of macadam	35,000 00
Total	$150,000 00

The totals in the tables accompanying the report show the following repairs necessary:

On the old round block cedar streets, 716,110 square yards on 266.5 miles of street, costing $572,888. If we assume the streets to be 36 feet wide on the average, this means the repair of ⅛ the area of this length of street.

On granite, 68,271 square yards on 21.18 miles of street, or one-fifth the area, costing $102,406.

On asphalt, 29,963 square yards on 56 miles of street, or about one-fortieth the area, costing $74,909. This is about one-fourth the total mileage of asphalt in the city.

On brick, 9,566 square yards on 22.25 miles of street, or about one one-hundred-and-twentieth of the area, costing $23,916.

On macadam, 289,858 square yards on 168.5 miles of street, costing $229,471.

The total cost of these repairs at the prices given is $1,003,590, and the superindendent is very modest in asking for $150,000, a sum which was much exceeded in 1898 and some previous years.

Sacrifice of Trees by Public Improvement.

The Supreme Court has rendered a decision holding that the property-owners

whose trees are about to be ruined by grading for the construction of new sidewalks have no recourse if the municipal authorities observe the law and do nothing unnecessarily. The case was appealed from Des Moines. That city tried to level a parking on E. Walnut-st. and have a sidewalk built to grade, which meant a cut of two feet in the parking and the ruin of a magnificent row of trees planted and tenderly nursed for thirty years. Justice Weaver said:

To the person who has planted trees, cared for them, protected them against violence, and has seen them grow and develop into things of beauty until he comes to regard them with genuine affection, this conclusion is no doubt unwelcome, but the court must administer the law as it finds it, and the rule we have stated is well settled. It is not an easy task to lay down any hard and fast rule as to the exact circumstances or combination of circumstances under which the court will restrain a city from the execution of a proposed plan of public improvement. The State having intrusted such work to the municipal authorities, the court cannot impose upon them its own ideas of utility, taste or beauty.

It is often the case that persons in municipal authority find beauty in dead uniformity and bend all their energies to reproduce in other streets the monotony of a checkerboard, squaring the angles, plowing down the slopes, filling up the valleys, leaving a portion of the population perched on inaccessible hights and others in yawning depths, and if in doing this work the letter of the law has been fairly observed there is no relief for the property owner who thinks himself injured, except such as he may derive from expressing his opinion on the subject.

While the court cannot interfere in a reasonable plan of improvement by a city and cannot compel the adoption of its own ideas of beauty and utility in the improvement of a street, yet the property owner whose trees are affected has a property interest in the trees which must be given consideration and no unreasonable molestation can be tolerated.

The Supreme Court thinks that the city may save the trees in question if it exercises reasonable care in doing the work of reducing the grade for the walk in this case. It suggests how this may be done and believes that there is at least a fair prospect that plaintiff's fears for the preservation of the trees will not be realized.

Indianapolis Can Sweep Its Own Streets.

In an opinion handed down by City Attorney Warrum at Indianapolis, Ind., Dec. 14, he held that the city has by its charter full power to provide for the sweeping of its improved streets by employes of the Board of Public Works. The contention arose out of a communication sent to the Board of Public Works by sixteen property owners who protested against the conversion of the South Side market house into a stable on the ground that it would damage their business. They also asserted that the city had no legal right to establish a street sweeping department of its own. The city attorney says the city has full power to sweep its own streets and even to assess the property owners for the cost. The board will proceed with its plans for the establishment, Jan. 1, 1905, of the new department.

Qualities of New Jersey Clay and Brick.

A report upon the clays and clay deposits of New Jersey has just been issued by Dr. Henry B. Kummel, the State geologist, as volume vi of the survey reports. The report discusses the origin and chemical and physical properties of clay, its distribution in the various geological formations in the State, the methods of manufacture of brick, hollow ware, conduits, terra cotta, tile, pottery and fire brick, and full economic descriptions of all the important clay beds. Under the direction of the State Geologist a series of experiments has recently been made on the breaking and crushing strength of New Jersey brick, and is described as follows:

Samples were collected from many brickyards and subjected to two sets of tests. In the first the brick rested on two supports, six inches apart, and pressure was brought to bear on the middle line of the brick between the supports. The amount of pressure necessary to break the brick was then determined. This varied from 240 pounds, in the case of a poor sandy brick made by the soft-mud process, to over 4,500 pounds for a hard, dense, compactly molded brick. In the case of many of those tested, the weight necessary to break them ranged from 2,000 to 3,000 pounds.

The other set of tests was carried out on half-brick and was made to determine the amount of pressure per square inch necessary to crush the brick. In order to obtain fair averages, several samples of each make were tested, and the re-

sults obtained ranged from 661 pounds to 13,873 pounds per square inch.

Careful study of the tests shows some very interesting facts regarding the brick. In the breaking tests the bricks made by the stiff mud process gave results nearly twice as high as those of the soft-mud brick. In the crushing tests the stiff mud bricks were also much superior to the others.

A full series of analyses and tests was also made to determine the refractoriness of New Jersey fire brick and its relation to their chemical composition and texture. Samples of nearly all the brands manufactured in the State were obtained, and these were chemically analyzed and also tested to determine their fusibility. The best brands did not fuse below the melting point of Seger cone 33, about 3,250 degrees Fahrenheit, while even the third or fourth grade of brick withstood temperatures of over 3,000 degrees Fahrenheit. These results compare very favorably with fire brick from other States, and in the few cases where the New Jersey brick are surpassed in refractoriness they often excel in toughness and durability.

CEMENT AND CONCRETE

Cement as a Protecting Material—Fire Tests of Concrete—Chicago Prices—Cement Block Building.

Cement as a Protecting Material.

By Edwin Thacher, M. Am. Soc. C. E., New York City.

The following from a paper on concrete and concrete steel, presented to the recent International Engineering Congress by Edwin Thacher, M. Am. Soc. C. E., gives a good statement of the present state of our knowledge regarding the protection of steel by cement in concrete, and as a paint, and the methods of finishing cement surfaces and making concrete impervious to water.

Protection of Steel in Concrete—Will concrete protect from oxidation iron or steel embedded therein? This is an important question, for, if not, concrete-steel construction will deteriorate, and in time fail, and as all engineers at least are not fully satisfied on this subject, such testimony as the writer has been able to collect will be of interest.

Spencer B. Newberry, Assoc. M. Soc. C. E., mentions a concrete-steel water main, on the Monier system, at Grenoble, France, 12 in. diameter, 1 ft. 6 in. thick, containing steel framework of 1-4 and 1-16 in. steel rods, taken up after fifteen years' use in damp ground. The adhesion was found perfect and the metal absolutely free from rust. He also mentions a concrete-metal retaining wall in Berlin which was examined after eleven years' use and the metal found free from corrosion, except in some cases where the rods were within 0.3 or 0.4 in. from the surface. Prof. Newberry explains how the effect of concrete in preserving metal is not due to the exclusion of air, and even though the concrete be porous and not in contact with the metal at all points, it will still filter out and neutralize the carbonic acid and prevent corrosion.

G. Bouscaren, M. Am. Soc. C. E., removed in 1875 several links from the anchorage of a suspension bridge partly built by Roebling in 1855, and they were found to be in a perfect state of preservation.

L. L. Buck, M. Am. Soc. C. E., states that he found rust on the anchorage of the Niagara suspension bridge when limestone was in contact with the metal, but where limestone was not in contact and no movement had taken place the metal was found in perfect condition after twenty-five years.

E. L. Ransome, Assoc. Am. Soc. C. E., saw, in Chicago, Ill., workmen breaking up slabs of limestone concrete which had covered sidewalk vaults for eight or ten years. The slabs had iron rods embedded which were rust free.

William Sooy Smith, M. Am. Soc. C. E., speaks of a small piece of iron set in mortar taken from the base of the obelisk in Central Park, New York City, which was bright after 2,300 years; he also says that in removing a bed of con-

crete at a lighthouse in the Straits of Mackinac, twenty years after it was laid, and ten feet below water surface, embedded iron drift-bolts were found free from rust.

Albert A. Trocon, M. Am. Soc. C. E., speaks of a bridge over the Osage river, Missouri, built on iron cylinder piers filled with Louisville cement limestone concrete, which was wrecked by high water after seven years' service. The center pier was overturned, leaving the bottoms of the cylinders, after the water subsided, in plain view. The concrete was removed from these cylinders for a depth of eight or ten feet and the iron was found absolutely free from rust.

Prof. Charles L. Norton made a large number of experiments with concrete bricks, 3 by 3 by 8 in., in which steel rods, sheet steel and expanded metal were embedded. The specimens were enclosed in tin boxes with unprotected steel and exposed for three weeks. One portion was exposed to steam, air and carbon dioxide, another to air and steam, another to air and carbon dioxide, and another was left on the table in the testing-room. His conclusions were as follows:

First—Neat cement is a perfect protection.

Second—Concrete should be dense without voids or cracks, and be mixed wet.

Third—The corrosion found in cinder concrete is mainly due to iron oxide in the cinders and not to the sulphur.

Fourth—Cinder concrete, if free from voids and well rammed, is about as effective as stone concrete.

Fifth—It is important that the steel be clean when embedded in concrete.

Sixth—It is essential that the steel be coated with cement before embedding in concrete, the unprotected pieces of steel being found to consist of more rust than steel.

M. Breuillie, a French engineer, made some interesting and valuable experiments on concrete-steel slabs subjected to high-water pressure. The slabs were 36 by 39 by 11.8 in., with steel rods and wires embedded at different depths in the slabs. The slabs were subjected for six days to intermittent water pressure of from 39.4 to 50.0 ft. The water penetrated every part of the slabs. The slabs were then left in the open air, and the condition of the metal tested from time to time and always found in perfect condition. He observed that the metal was dull after contact with the concrete; that adhesion was destroyed where the water had penetrated; that bars, having a slight layer of rust when embedded, were free from rust in 15 or 20 days; that water after passing through the slabs contained less mortar salts than before; that under pressure of 50 ft. adhesion was destroyed, but bars did not rust. He concludes that a salt is formed by the action of the cement on iron, which is dissolved by water.

Professor Norton gives the result of further tests on the protection of steel embedded in concrete. Specimens of steel, clean and in all stages of corrosion, were embedded in stone and cinder concrete, wet and dry mixtures, and exposed to moisture, carbon dioxide and sulphurous gases. Some were treated in tanks supplied intermittently with steam, hot water, moist air, dry air, and continuously with carbon dioxide for from one to three months. Under the conditions followed, unprotected steel vanished into streaks of rust, but protected by an inch or more of sound concrete, the steel was absolutely unchanged, and he concludes that steel embedded in concrete, mixed wet and well, whether stone or cinder concrete, will be perfectly protected for all time.

Mr. Ransome mentions that in tearing up some sidewalk in Bowling Green Park, New York City, which had been in use twenty years, some embedded steel rods were found to be in perfect condition. Other examples could be given, but the writer considers the above sufficient to clearly establish that concrete is a perfect protection for embedded steel.

Cement Paint—Cement paint is said to be largely used by the railway companies of France to protect the metal work of bridges from rust and locomotive gases. The metal is brushed and dampened and given two coats of liquid cement and sand. It was used for protecting the steel beams of the Boston Subway, and is used largely in European distilleries for painting iron spirit tanks, the adhesion being increased by allowing the metal to rust somewhat before applying the paint. The writer knows of some cases in the United States where cement paint was used without success, as it failed to adhere to the entire surface, and if there is any sure way of making it do so the writer hopes the discussion will bring it out, for if satisfactory adhesion of cement can be secured, either with or without sand, it will undoubtedly prove to be the best paint and the most perfect protection for exposed steelwork known. For protecting steel bars buried in earth, the writer has wrapped with canvas soaked in thick Portland cement grout with a heavy coat-

ing of grout over the canvas, and believes it will be permanently effective.

Finish—The greatest objection to the use of concrete for the exposed surfaces of structures in which beauty is an important consideration is the difficulty of producing a satisfactory finish. Concrete, as it usually comes from the molds showing the joints, knots and grain in the casing, has more the appearance of a piece of rough carpenter work than of finished masonry, and some special treatment is necessary. Concrete is faced frequently with masonry, brick or tile, but this dodges the case without meeting it. Plastering is resorted to frequently, but not always with success. E. Duryea, jr., M. Am. Soc. C. C., mentions some examples which gave good results. The portals of two tunnels in Los Angeles, Cal., were plastered with two coats of 1 cement, 4 sand and 1 lime paste; where finished rough it did not show hair-cracks, but when finished smooth it did show them. The concrete pedestals of Kaskaskia Viaduct, Chicago & Eastern Illinois Railway, are plastered with 1 cement, 1 sand and are in first-class condition. The piers of the Arkansas River bridge, Kansas City Southern Railroad, were plastered with three coats, the first two, 1 cement, 3 sand, and the third, 1 cement, 1 sand, and are in good condition. Mr. Duryea considers a mixture of 1 cement, 3 sand, 1 lime paste the safest and best, and that excessive troweling should be avoided, and the plastering kept damp for two weeks. A concrete bridge at Oconomowoc, Wis., built by Stamsen and Blome of Chicago, Ill., had a mortar face composed of 1 part cement, 1 part granite screenings and 1 part torpedo sand. On the second day after completion the molds were removed and the surface rubbed with a soft stone and water. The Inman arch Hohenzollern had a facing of 1 part cement and 5 parts broken limestone. After setting twelve hours the loose cement was removed by water and brushes.

About the same process was followed by H. H. Quimby, M. Am. Soc. C. E., for a bridge in Philadelphia, Pa. The walls of the Pacific Borax Company's factory at Bayonne, N. J., are finished to represent coursed ashlar work by inserting wooden strips in the molds, and dressing the faces with a pneumatic hammer. One man was able to dress from)00 to 600 sq. ft. in 10 hours, or from 100 to 200 sq. ft. by hand. Many of Mr. Ransome's buildings are finished in this way, and the effect is good. A very good finish can be produced by using smooth molds, and depositing wet concrete directly against them; then, after removing the molds, floating the surface with a wooden float, using only sufficient mortar to fill the pores, and to give a smooth finish. Mr. Cummings has produced a good finish by going over the surface with a wire brush while the cement was still green.

B. E. Turnbull, Chief Inspector of the ten-span, concrete-steel viaduct for the Utica & Mohawk Valley Railway at Herkimer, N. Y., produced a very superior finish in the following manner: For a hard wall, the surface was wet and a thin 1:2 mortar was applied with a brush. The surface was then thoroughly rubbed with a piece of grindstone or carborundum, removing all board marks and filling all pores, producing a lather on the surface of the concrete, and before this had time to dry it was gone over with a brush dipped in water, producing a smooth finish and uniform color. For a green wall, when the moulds were removed in less than seven days, the surface was wet and a thin grout of pure cement was applied with a brush, the surface was then rubbed with a piece of grindstone or carborundum and finished in the same manner as previously stated. The same process is being used for the eleven-span, concrete-steel viaduct over the tracks of the Atlantic Coast Line, Seaboard Air Line and Florida East Coast Line at Jacksonville, Fla., and the results are exceedingly satisfactory.

George W. Lee, Jun. Am. Soc. C. E., describes the method used by the New York Central Railroad for giving a good finish to exposed concrete surfaces. The forms of 2-in. tongued and grooved pine were coated with soft soap, all openings in the joints of the forms being filled with hard soap. The concrete was then deposited, and as it progressed was drawn back from the face with a square-pointed shovel, and 1:2 mortar poured in along the forms. When the forms were removed, and while the concrete was green, the surface was rubbed with a circular motion with pieces of white firebrick, or bricks composed of 1 part cement and 1 part sand; the surface was then dampened and painted with 1:1 grout rubbed in, and finished with a wooden float, leaving a smooth and hard surface when dry.

Impermeable Concrete — Impermeable concrete, or concrete made impermeable by some kind of waterproof coating, is frequently required, either for inclosing a space which must be kept dry, or for storing water or other liquids, and quite

a number of valuable experiments have been made for the purpose of discovering the most effective way to accomplish this result.

In 1902, Mr. J. B. McIntyre and A. L. True, Jun. Am. Soc. C. E., of the Thayer School of Civil Engineering, made 97 experiments to determine if possible a concrete which would be impermeable to water under high pressures. The specimens were 10 in. in diameter and 9 in. high, with ¾-in. pipe inserted to a depth of 4 in. The specimens were subjected to a pressure of 20, 40 and 80 lb. per sq. in. for 2 hours. All specimens containing from 30 to 45 per cent of 1:1 mortar were impermeable, some of the specimens containing from 40 to 45 per cent of 1:2 mortar, and some specimens of 1:2:4 and 1:2½:4 were also impermeable under a pressure of 80 lb. per sq. in., equivalent to a head of 184 ft. They recommend 1:2:4 or 1:2½:4 concrete for moderate pressures.

At the annual convention of the American Society of Civil Engineers, in June, 1903, there was an informal discussion on impervious concrete which brought out some valuable matter. R. W. Lesley, Assoc. Am. Soc. C. E., quotes the conclusions of M. R. Feret, a noted expert of the French government, as the result of a large number of experiments extending over a period of five years. He found that permeability diminished as the proportions of cement increased, also diminished rapidly with time, that the concrete should be mixed wet, and is least permeable when the proportions of medium-sized grains are about equal to each other.

From experiments made by Italian engineers at Genoa, Italy, it was found that a mixture of 1:3.5:4.5 was impermeable under a head of 13 feet., and barely permeable under a head of 27 ft., and that a mixture of 1.0:2.2:2.7 was impermeable under a head of 40 ft.

It is generally considered that a monolithic construction, a wet mixture, a rich concrete and an aggregate proportioned for great density are essential for impermeability.

Mr. William B. Fuller thinks that extra insurance of impermeability can be secured by reversing the ordinary process of machine mixing, introducing the water first, then the cement to form grout, then the sand, and lastly, the stone or gravel.

Prof. Baker gives the following formula for making mortar impervious. One per cent by weight of powdered alum is added to the dry cement and sand, and 1 per cent of potash soap (ordinary soft soap is good) is dissolved in the water used in mixing. W. K. Hatt, Assoc. M. Am. Soc. C. E., has used with success a 5 per cent solution of alum and water, and a 7 per cent solution of soap and water, these solutions being used in equal parts in mixing the mortar or concrete.

Various coatings have been used to render concrete water-tight. For cistern work two coats of Portland cement grout has been found sufficient. About 1 in. of rich Portland cement mortar has usually been found effective under high pressure. A coating of asphalt alone, or asphalt with tarred or asbestos felt laid in alternate layers between layers of concrete, has often been used with success. Coal tar pitch and tarred felt in alternate layers has been used extensively and successfully in New York City for water-proofing. Capt. William C. Langfitt, Corps of Engineers, U. S. A., has used successfully a water-proofing wash composed of one pint of an alum and lye solution mixed with 10 lbs of cement, thinning with water until the mixture spreads easily with a brush. It should be applied while the concrete is green and until it lathers freely. The solution consists of 1 lb of concentrated lye, 5 lbs of alum and 2 gal. of water. Eugene W. Van C. Lucas, M. Am. Soc. C. E., Capt, Corps of Engineers, U. S. A., used boiled linseed oil with success, coating the surface until the oil ceased to be absorbed.

Fire Tests of Concrete.

The standing of concrete with the insurance companies is a matter which is of much importance and it is necessary that the facts be definitely ascertained that injustice may not be done to the new building material on the one hand or the safety of buildings on the other.

Professor Ira H. Woolson of Columbia University has been making tests of various materials and methods of construction to show their resistance to fire and to the action of water in putting out the fire when under load. The tests have been made in co-operation with the building bureaus of the City of New York.

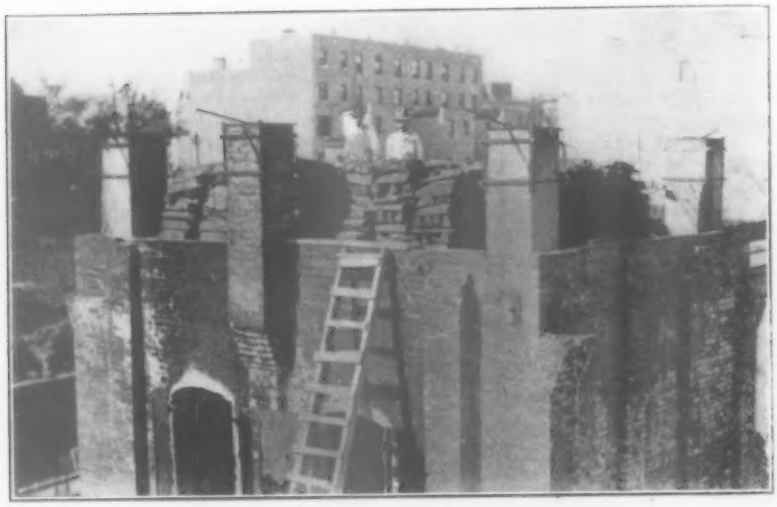
The first published report of these tests has just been issued and will be followed by others at intervals until all the tests thus far made have been described, and afterward from time to time by reports of future tests as they may be made.

The test described in the report was made upon a reinforced concrete floor constructed according to the Kahn system. We are indebted to Professor Woolson for a copy of the re-

port, which can be obtained of the Columbia University Fire Station for 25 cents, and to the Trussed Concrete Steel Company for the accompanying photographs of the progress of the test. An abstract of the report follows.

The test was made Sept. 30, 1904, beginning at 10:30 a. m. Water was applied to put out the fire at 2:31 p. m. The final loading of the floor was made October 3. The age of the floor when tested was twenty-nine days.

The test building is 19 by 14 feet on the inside. The walls are of brick, lined with reinforced cinder concrete. It is supplied with six chimneys and suitable draft openings through the walls at the bottom.



FIRE TEST OF REINFORCED CONCRETE.
Kahn System. View of test building and floor load.

The grate is located 2 feet 6 inches above the ground. The ceiling is 9 feet above the grate.

The floor to be tested constituted the roof of the building, and was carried on two reinforced concrete girders of the same system as the floor. These girders were 18 inches deep, including the floor, of which they formed a part. They were spaced on 15 feet centers and had a clear span of 14 feet between the walls. The actual clear span of the floor slab between the girders was 13 feet 8 inches.

The reinforcing metal in both floor and girders was the peculiar Kahn bar with its wing projections. The bars in the floor were ½ inch square, one set spaced on 8 inch centers running from girder to girder and another similar set at right angles to the first, but spaced 2 feet apart. One inch bars were used in the girders.

The concrete for the floor was mixed in proportion of 1 cement, 2½ sand and 5 broken stone, and 1, 2, 4 for the girders. "Vulcanite" Portland cement was used, and the stone was trap rock crushed to ¾ inch size. Ceiling was not plastered.

The purpose of the test was to determine the effect of a continuous fire below the floor for four hours at an average temperature of 1,700 degrees F., the floor carrying at the same time a distributed load of 150 lbs. per sq. ft.; at the end of the four hours the underside of the floor (or ceiling) while still red hot, to be subjected to a 1¼-inch stream of cold water at short range, through 100 feet of hose under 60 lbs. pressure for five minutes, then the upper side of the floor (which forms the roof of the test building) to be flooded at low pressure; afterwards the stream to be again applied at full pressure at the underside for five minutes longer.

Deflections of beams and floor to be measured continuously during the test. The load then to be removed and when cold reloaded to 600 lbs. per sq. ft. and deflections noted.

The temperatures of the fire were obtained by electric pyrometer couples suspended through the floor from above and hanging about eight inches below the ceiling.

Readings were made upon each couple

every three minutes. The fuel used was dry cord wood, the frequency of firing being determined by the temperatures of the test chamber.

The deflections which occurred at various stages of the test were measured by a Y level reading upon rods located upon the ends and middle of each girder, also upon the middle and each side of the floor slab.

The water was applied by firemen with a steamer detailed from the fire engine house at Amsterdam-ave. and One Hundred and Thirteenth-st., under direction of Chief Livingston of that station. The pressure gauge was carefully watched and full 60 lbs maintained.

In applying the water, the stream was thrown back and forth over the whole ceiling as much as possible and not allowed to strike continuously on one spot. After five minutes' application the pressure was reduced to about 30 lbs and the top of the floor flooded 2 inches deep, then the stream was applied to the ceiling again at full pressure for five minutes longer.

Owing to the very light atmosphere at the time of starting, the smoke came out of the chimneys and immediately fell to the ground. This condition existed for over an hour, resulting in checking the fire and lowering the temperature. A better atmosphere prevailed during the latter part of the test, and high heat was obtained without difficulty. It was necessary to maintain rather high temperature during this period to compensate for the low temperature during the early part of the test.

During the test several cracks developed on the roof, running in various directions, as the floor sagged from expansion due to the heat. Most of these were one-sixteenth to one-eighth inch in width, and two feet four inches long. One started from middle-west chimney and ran south parallel to wall and about one inch from the wall. This opened three-eighth inch on top, but did not appear to extend through to the under side. No cracks were visible on the under side. No cracks were visible on the under side, and later when the roof was flooded no leaking of water through the cracks was noticeable.

FIRE TEST OF REINFORCED CONCRETE.
Kahn System. Applying water to extinguish flames.

The ceiling was in excellent condition. The concrete was somewhat pitted where subjected to the force of the water, but no flaking had occurred and no cracks were apparent except a horizontal crack about three feet long in the side of the south girder, and a few very small cracks in the bottom of each girder.

No exposure of the reinforcing metal was made except a few small holes about

one-half inch in area. Practically the metal protection in floor and girders was complete.

There was a deflection of 4⅛ inches in the middle of the floor span during the fire; this included a deflection of 1⅜ inches in the middle of the girders. When the load was removed and the floor allowed to cool the deflection was reduced to 1⅝ inches for the floor, and 5-16 and 6-16 inches respectively for the girders.

The final loading to 600 lbs. per sq. ft produced a total deflection in the middle of the girders of 15-16 and 1⅛ inches respectively. The deflection of the floor slab relative to the girders when under full load was 2 3-32 inches.

The full load was left on the floor sixteen hours with practically no increase in deflection. After the load was discharged a recovery of about an inch was noted, though it was not accurately measured.

As a result of the test the superintendent of buildings of the Borough of Manhattan approved of the use of this system as a fire proof construction under the building regulations of the department, provided there is at least one inch of concrete protecting the steel and that the minimum thickness of floor and slab construction is 4½ inches.

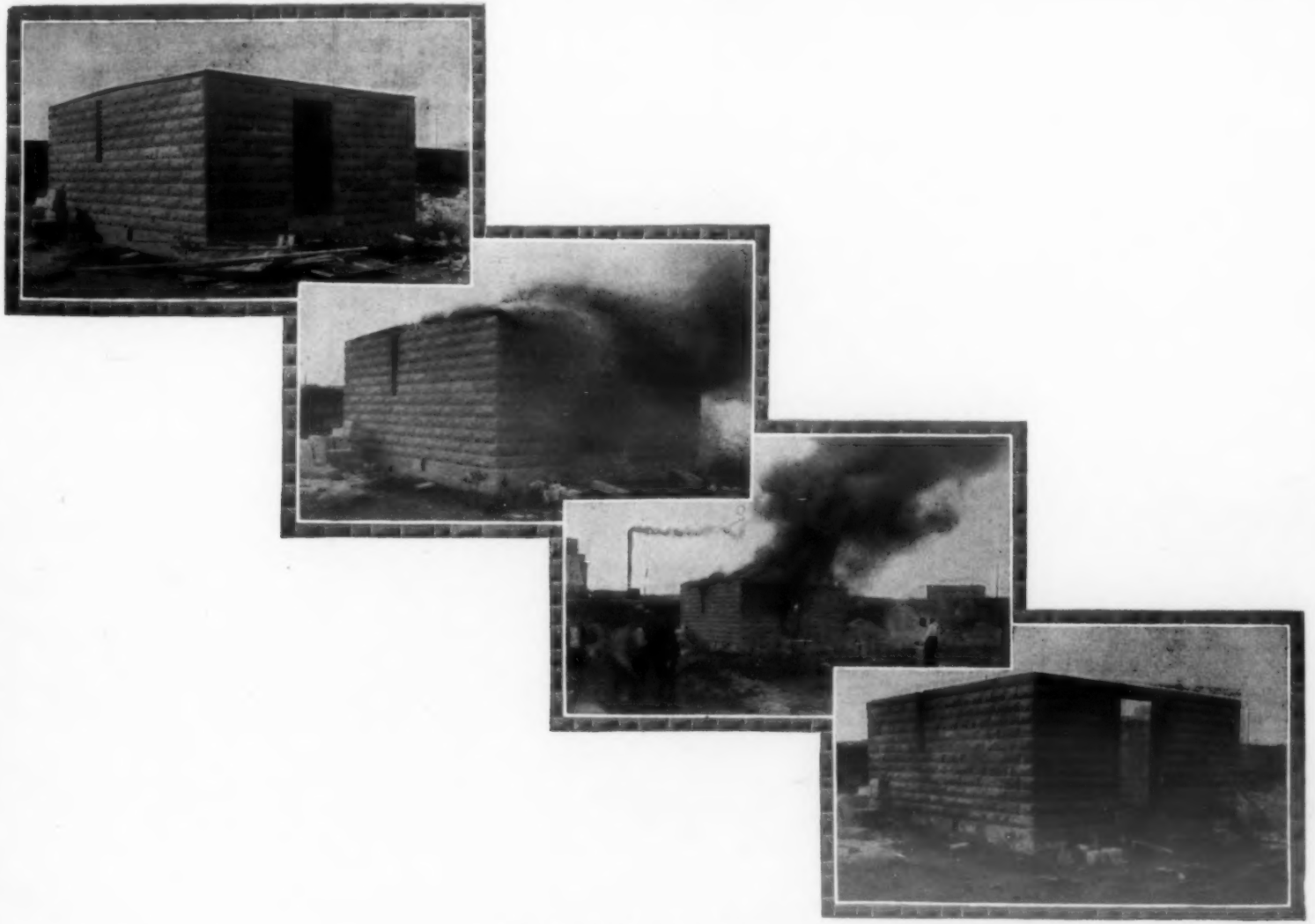
In Municipal Engineering, vol. xxvii, p. 447, was an account of a fire test of hollow concrete block taken from the "Improvement Bulletin." This test was stated to be of blocks made on the Harmon S. Palmer machine and seems to have been made late in 1902 or early in 1903.

The following from the "Daily Oklahoman" of Sept. 25, 1903, gives an account of a fire test on Sept. 22, 1903, of a test building constructed of Normandin hollow blocks, made by the Oklahoma Stone Manufacturing Company, 115 of the 14-inch blocks and 425 of the 10-inch blocks being used:

FIRE TEST OF REINFORCED CONCRETE.
Kahn System. Ceiling of test room after fire and application of water.

This building was erected exclusively of hollow cement stone on a concrete footing or foundation 18 inches thick and 8 inches deep upon top of which two courses high of 9 inches and 14 inches in thickness each of artificial stone were laid, on top of which 10 courses high of hollow artificial stone 10 inches in thick-

FIRE TEST OF CONCRETE BLOCKS.
Normandin Blocks. Views of test building before, during and after fire.



FIRE TEST OF CONCRETE BLOCKS.

Normandin Blocks. Views of test building before, during and after fire.

ness, 9 inches in height were laid, on top of which a flat board roof was placed, being made of 1x12 boards laid on the frame work and then covered in cross sections by 2x12 planks. On the interior of this building a furnace or oven of alternate layers of natural stone hollow concrete block and brick was built. On the west and east end respectively there were doors left for the purpose of making exit and entrance respectively to the building. The interior of the furnace mentioned was filled with wood, consisting of dry wood and oak railroad ties cut in quarters. Around the furnace on the outside and on the interior of the building were piled four wagon loads of barrels, boxes and other inflammable and combustible materials, on top of which were placed two barrels of tar and about fifty crossties. Over the whole mass was poured a barrel of kerosene oil, after which a match was applied. The whole building was at once enveloped in a mass of flames and the fire chief expresses it as his opinion that it was one of the hottest fires he ever experienced, and far too severe a test for a building of that size. The fire was allowed to burn until practically the climax or full force of same was reached, when the fire department was called upon and requested to throw water upon the fire, being very particular to put the water on the walls of the building and the furnace on the interior of the same

One noticeable feature of the construction was the lack of any anchors for braces or any steel bands or ties, in fact, from an architectural standpoint, the building was only four straight walls without any structural reinforcement whatever.

The fierce heat caused a few slight cracks in the superstructure of the building, caused primarily by the excessive heating on the inside of the building against the cooler outside. The water apparently had no effect upon the stone.

Upon close examination after the fire had been put out it was found that the concrete stone was intact, that the natural stone had cracked and the brick where exposed had shaled off or could be shaled off with the fingers, having been cracked loose and in no shape for future use.

The accompanying plate shows four photographs of the building before, during and after the test, for which we are indebted to the Cement Machinery Company of Jackson, Mich., the manufacturers of the Normandin machine.

Cement Prices in Chicago.

By C. B. Maugham, Chicago, Ill.

Cement business continued more active throughout December than it has been during the same period in a number of years past. Deliveries were continued long after the season when it is usually possible to do outdoor work, and the length of the season has done much to make up for the low prices that have prevailed. Prices showed very little change over recent months and most of the business was at approximately $1.25 f. o. b. Chicago. With the action of the Association of American Portland Cement Manufacturers in agreeing to put prices up gradually after the new year till they reach $1 at the mills in the spring, there was considerable activity among heavy consumers of cement to get their contracts through for next year. A number of these have already been submitted and bids are being made for the business. It is said that these do not show any great stiffening tendency, but that on the contrary many are offering to take the business at practically present prices. This is said to be on the theory that it is better to have as much contract business as possible in order to be able to regulate the operations of the mills to better advantage and then depend upon the surplus business that may come in later to make the profits that are anticipated from the proposed higher prices. The amount of future business is naturally a matter of conjecture but rough estimates are very high and spring and summer are looked forward to as being very active and profitable. The action of the New York meeting is expected to have almost immediate effect here in the open market and it is expected that a gradually rising scale of prices will be quoted from this time forward till the full new list is in effect. This gives opportunity for a rise from the present base of approximately $1.25 up to $1.63, which would be the $1 rate agreed upon at the seaboard plus the railroad rate of 53 cents and 10 cents commission. After navigation opens in May the rate will be somewhat lower, or on a basis of 46½ cents for transportation. Thus it would appear that future prices in cement would necessarily range from $1.56½ to $1.63 during the coming spring and summer unless conditions should arise to put the price still higher, but with matters so arranged that there is little opportunity of their being any lower than the prices quoted after the earlier months of the new year.

NATIONAL ASSOCIATION OF CEMENT USERS

While the arrangements for the convention called for the purpose of forming the National Association of Cement Users have not yet been completed the local committee has been very successful in making the early preparations for the meeting and can now insure a very successful convention.

While the first suggestion of an association came from a concrete block manufacturer and the early agitation of the matter was among the block makers, much interest has been expressed by users of cement in many other kinds of construction and the program has been prepared with the interests of all in mind. There will probably be so many in attendance at the convention that it may be deemed advisable to divide the convention into sections in the future for the consideration of special lines of cement and concrete work.

On the first day of the convention there will be an opportunity to register at headquarters and secure badges, numbered for easy identification and introduction of the wearers, during the morning of Tuesday, Jan. 17. The exhibits of machinery and materials will also be in running order at this time. In the afternoon there will be a session for preliminary organization at which temporary officers will be selected and a committee appointed to present a plan for a permanent organization. On the second day a time is provided for the report of the committee on permanent organization, the election of officers for the first year and the formation of a roll of permanent members. The proper machinery for the new secretary and treasurer will be provided in anticipation of favorable action upon the question of the formation of the association so that it may get into running order as promptly as possible.

The social features will not be neglected and a smoker or banquet will be provided for in the completed program.

A number of good speakers have been secured for the meeting who will lead the discussions upon the subjects of most interest to the members of the association. These papers and speeches will be distributed through the sessions so as to give opportunity for full discussion. The following have been promised:

"The Testing of Cement," by Richard L. Humphrey of Philadelphia, an expert member of the committees on testing of cement appointed by the American Society of Civil Engineers, the Society for Testing Materials, Association of Portland Cement Manufacturers, and others.

"Methods and Results of Cement Testing," by Walter Buehler, assistant City Engineer of Indianapolis, in charge of testing laboratory.

"Quality of Sand," by James C. Hain, Engineer of masonry construction, Chicago, Milwaukee & St. Paul Railway.

"Practical Mixing of Mortar and Concrete," by Kirk H. Brown, an expert maker of concrete blocks.

"The Mixture of Concrete," by A. L. Goetzmann of Chicago.

"The Testing of Cement Blocks," by John R. Allen, junior professor of Mechanical Engineering, University of Michigan.

"Coloring of Cement," by J. P. Sherer of Milwaukee, Wis., an enthusiast on cement work.

"Waterproofing of Concrete," by W. H. Finley, principal assistant engineer Chicago & Northwestern Railway Company.

Nearly all of these papers are certain to be presented and others on the architect and concrete construction, waterproofing concrete blocks, sidewalk and curb construction, etc., are under negotiation to take the place of any failures. There will also be speeches at the smoker by ex-Mayor John W. Lane of Carthage, Mo.; Dr. Geo. F. Row of Circleville, O.; Arthur N. Pierson of New York City and others, including a good representation from the convention city.

One of the features of the convention will be a question box which will be opened at frequent intervals. Those who have particularly hard nuts to crack are requested to send them to the chairman of the local committee at once that they may be assigned to some expert for answer.

The exhibit of materials and machinery for cement users will be one of the most interesting features of the convention. The local committee having this matter in charge reports that within one week after the circular letter regarding exhibit space was issued contracts were made for 2,000 square feet of

space and that contracts and inquiries leading to contracts are received by every mail. There will be more than three times as many cement block machines on exhibition as were in operation at the St. Louis exposition. The Association of Cement Manufacturers has appointed a committee to insure full representation of cement at the convention. Concrete mixers, mortar colors, waterproofing compounds, steel reinforcement, etc., etc., will also have full representation, and many manufacturers of materials and machinery which cannot be set up in such an exhibition as this, will have representatives in person and by printed matter of various kinds. The present arrangements contemplate the location of the convention hall and the exhibit rooms on the same floor or on two floors of the same building so that everything will be as convenient as possible for the members of the convention. The above statement regarding the number of concrete block machines on exhibit is proof that the convention will be the place to compare machines and methods of making blocks.

Reduced rates will be granted by the railroads in the Central Passenger Association on the usual certificate plan whereby the purchaser of a ticket pays full fare to Indianapolis and procures from the ticket agent from whom he purchases the ticket a certificate that he has purchased the ticket. Application for these certificates should be made at once upon reading this notice as many agents are not supplied with them and must send for a supply. It is probable that other Passenger Associations will grant the same rates. Certificates should be obtained in any event that the reduced return fare may be secured for the return trip in the Central Passenger Association territory. Certificates must be signed by the local secretary of the convention, Charles C. Brown, and presented to the railroad agent at the convention on Jan. 18. He will stamp them and make them call for a return ticket at one-third the regular fare one way. The Central Passenger Association territory extends east from Chicago, St. Louis and Cairo to Buffalo and Pittsburg and lies north of the Ohio river. All persons attending the convention can procure the rate of one-third fare for the return trip in this territory by paying full fare going to the convention and procuring the certificate. It is probable that nearly all can secure the reduced rate from their own railroad stations. The reduced rates cannot be secured if the certificate is not obtained of the ticket agent of whom the ticket going to the convention is purchased, and if it is not signed also by the local secretary of the convention. The Southeastern Passenger Association does not grant the reduced rate.

The headquarters of the convention will be at the Claypool Hotel. The sessions of the convention will be held in a hall on the eighth floor and the exhibition rooms are on the same floor.

Rates at the Claypool Hotel are as follows.

SHELTER HOUSE IN RIVERSIDE PARK.

Monolithic concrete with cement facing.

CONCRETE-STEEL BRIDGE, INDIANAPOLIS.
Melan arch on Illinois street over Fall creek.

CONCRETE-STEEL BRIDGE, INDIANAPOLIS.
Melan arch on Meridian street over Fall creek.

When two or more persons occupy a room without bath, the rate will be from $3 per day upward for each person on the European plan. For single rooms without bath from $3.50 per day upward for each person on the American plan or $2 per day and upward for each person on the European plan. For rooms with bath, when two or more persons occupy the same room, the rate will be from $3.50 per day upward, for each person on the American plan or $2 per day and upward for each person on the European plan. For single rooms with bath, from $4 per day upward for each person on the American plan or $2.50 per day and upward for each person on the European plan. The hotel has about 384 rooms and can accommodate as many members as desire to come at the rates they wish to pay within the above limits. For those who wish lower rates accommodations can be secured at Hotel English, Denison Hotel, Grand Hotel, Spencer House, Lorraine Hotel, Imperial Hotel, Oneida Hotel, etc., etc., at various rates from 50 cents a night for room alone up. Full list will be found in the circular regarding the program which is ready to issue by the time this article is read. There are also boarding and rooming houses and restaurants to suit any one's desires. A committee will be in attendance at headquarters to direct members to the kind of entertainment they desire.

Indianapolis has some cement and concrete work to show, four examples of which are shown in the accompanying photographs. A committee will be on hand to direct inquirers to whatever they may wish to see.

The program, as stated above, is ready for distribution about the time this number of Municipal Engineering is read and those who wish to distribute copies of it can obtain them by addressing the chairman of the local committee, Charles Carroll Brown, C. E., 408 Commercial Club Bldg., Indianapolis, Ind. It is impossible to reach directly all those interested in the convention and the committee requests that those who read this article will aid in spreading the news by word of mouth and by sending for and distributing the circulars.

SHELTER HOUSE IN MILITARY PARK.
Palmer hollow concrete blocks.

Members of the various committees to this date are: Charles C. Brown, chairman of local committee; A. J. Ralph of the committee on hotel and boarding house accommodations; A. R. Edmonds, of the committee on exhibits; H. E. Goodwin and C. F. Childer of the committee on inspection of local works. Committees on introduction, on social features and on reception will also be appointed. All will be provided with proper badges and men coming to the convention will feel free to call on them for any information or assistance they may desire.

The convention will be large and successful. The members can add greatly to the success of the social features by doing their individual shares toward getting acquainted.

MUNICIPAL AND TECHNICAL LITERATURE

Detroit Asphalt Repairs—Appleton Water Pollution—Municipal and State Reports.

Cost of Detroit's Asphalt Repairs.

The report of Clarence A. Proctor, the expert in charge of the municipal asphalt repair plant in Detroit, Mich., to the Commissioner of Public Works on the cost of the work for the season of 1904 has been made.

In this report no account has been taken of guarantee or maintenance charges on the work done, as there exists such wide difference of opinion in regard to what constitutes a proper estimate for that purpose. There is also no reference to depreciation of plant and equipment, as this season's work was so short that the wear on the same was hardly perceptible, no breakdown of any kind having occurred and not one dollar having been expended for repairs.

The report is as follows:

Materials Received—

Asphalt, 895.25 tons at $25.50	$22,828.88
Asphaltic oil, 381.72 tons at $25.90	9,886.55
Sand, 3,606.82 cu. yds. at $0.56	2,019.82
Binder stone, 2,536.72 tons at $0.90	2,283.05
Stone dust, 358.1 tons at $3.50	1,253.35
Coal, 350.54 tons at $2.65	928.93
Wood, 79.72 cords at $4.86	387.43
Cement, 44.50 bbls. at $0.75	33.38
Lubricating oil	131.28
Total	$39,752.67

Inventory—Materials on Hand—

Asphalt, 341.87 tons at $25.50	$ 8,717.69
Asphaltic oil, 106.16 tons at $25.90	2,749.55
Binder stone, 30 tons at $0.90	27.00
Stone dust, 10 tons at $3.50	35.00
Credit on old oil bbls. sold	333.58
Total	$11,862.82
Total cost of materials used	$27,889.85

Labor—

At plant, per pay rolls	$10,722.88
On street, per pay rolls:	
Gang No. 1	6,384.98
Gang No. 2	3,935.32
Gang No. 3	254.67
Total cost of labor	$21,297.85
Total cost of labor and material	$49,187.70

Work Performed and Cost of Same—

General patching, city work, sq. yds., 33,994.40, at 836	$28,424.47
Private patching, sq. yds., 10,327.88, at .991	10,241.72
Resurfacing Jefferson-ave., Baldwin to Iroquois, sq. yds., 5,730, at .876	5,018.71
Resurfacing Fourth-ave., Michigan to Locust, sq. yds., 6,539.67, at .841	5,502.80
Total	$49,187.70

Average analysis of mixtures on patchwork was 10.98 per cent bitumen; the maximum being 12.53 and the minimum 10.55. On Jefferson-ave. resurfacing the average was 12 per cent bitumen; the maximum 12.63 and the minimum 11.06 per cent. On Fourth-ave. the average was 11.93 per cent bitumen; the maximum being 12.13 per cent and the minimum 11.71.

The average of sand sifting for the season was as follows:

Retained on 20-mesh sieve	6 per cent
Retained on 40-mesh sieve	16 per cent
Retained on 60-mesh sieve	26 per cent
Retained on 80-mesh sieve	23 per cent
Retained on 100-mesh sieve	11 per cent
Passing 100-mesh sieve	18 per cent

The higher price shown for private work was due to the fact that the work consisted of repairing breaks along street railway tracks where no binder could be used, necessitating the use of the more expensive topping material, and also in repairing cuts in various sections of the city, where much time was consumed in moving gangs.

The variation in the prices for surfacing work between Fourth and Jefferson-aves. was due to the longer haul of material to the last named street.

The Appleton, Wis., Water Pollution Question.

Information has been received that the statements in the article in Municipal Engineering, vol. xxvii., p. 456, entitled

Appleton (Wis.) Water Pollution Not Enjoined," which were taken from the Wisconsin daily papers, are not accurate. The following statement of the proceedings in this matter is made by the Appleton Water Works Company as being a correct abstract of the records in the case:

The injunction asked for by the Appleton Water Works Company to restrain the City of Appleton from constructing the Mason-st sewer, which has its outlet in the Fox River, about 1,000 feet up the river from the intake of the Appleton Water Works plant, was settled by stipulation and special agreement as follows by Judge Burnell of Oshkosh.

The City of Appleton alleged in its answer to the complaint of the Appleton Water Works Company that the intention of the Mason-st. sewer was for the purpose of discharging storm water only and offered to stipulate that this sewer should in future be used for this purpose only, provided the city was allowed to finish construction. The Appleton Water Works Company accepted this stipulation and Judge Burnell denied the injunction as to the finishing of the construction work, which had already begun, but enjoined the city from hereafter making any connections to this sewer for sanitary or other sewerage, except storm water, thus enjoining the city against pollution of the Water Company's intake.

Since rendering this decision the Appleton Water Works Company has brought suit against the City of Appleton to enjoin the City of Appleton from issuing $300,000 water works bonds, for the purpose of building a competing water works plant in this city, on the grounds that the issuing of these bonds would exceed the constitutional limit of the city's indebtedness. The City of Appleton has made answer to the Court that the complaint of the Appleton Water Works Company is true, and the City Council has rescinded its action authorizing the issuing of the bonds in question and the costs of the action have been charged to the City of Appleton. The ordinance repealing the ordinance authorizing the issue of the bonds was published officially Dec. 11, 1904.

These two decisions will be of great interest to many Water Works Companies throughout the Western States whose franchises, running twenty and thirty years, are about to expire, as it defines the rights of cities intentionally or carelessly to pollute the water supply of a Water Company or to build a Water Works plant contrary to law.

Municipal and State Reports.

First Annual Message of John Weaver, Mayor of Philadelphia, with annual reports of the Department of Public Works and the Bureau of Filtration. Peter E. Costello, Director; John W. Hill, Chief of Bureau.

The Mayor's message calls attention to the work of the various departments, usually with commendation. It rehearses the efforts to secure competition in asphalt pavements under former ordinances and the final passage of an ordinance by the Council opening the field to all good asphalts.

The report of the Director of Public Works shows 49 miles of pavement laid during 1903, of which 27 were macadam, 16 sheet asphalt and 3 each were granite block and brick.

This makes a total of 1,225 miles of paved streets in the city, only 263 being macadam, 338 sheet asphalt and 368 granite block. There are 13 miles of granolithic pavement and 10 miles of slag block, 73 miles of cobble or rubble pavement are left and there are 142 miles of brick and 19 miles of asphalt block. There are still 437 miles of unpaved streets. The street railways paved over 11 miles of streets in 1903 at a cost of about $150,000, under their charters requiring pavement of the streets occupied by their tracks.

The gas and gasoline lamp lights in the city are maintained by this bureau. The number of lamps in use in 1903 was 34,481, of which 13,034 were gasoline. The total cost including contract price of maintaining and the salaries and office expenses was $328,922. The contract price for gasoline lights for 1904 is $21 per year for 20 candle-power lights and $29.50 for 60 candle-power lights.

Street cleaning covered 962 miles of streets, 20,688 inlets and many private alleys. The total for the year was 230,239 miles of street, 1,083,759 sewer inlets, 158,074 private alleys, making 218,928 loads of dirt. Ashes, dry waste and garbage made nearly a million loads. The total cost, including disposal of garbage, was $1,182,573.

The receipts of the water department for the year were $3,594,754 and the expenditures $1,463,065 for current expenses

and $6,074,269 for extensions. The average per capita consumption was 237.5 gallons.

Mr. Hill's report gives the details of the construction of the new filter plants, the contracts and expenditures. It is handsomely illustrated with many photographs of the work under construction and of drawings, plans, machinery, etc.

Many results of tests of crushing strength of concrete cubes are given.

An appendix gives the contract prices for every contract which has been let.

Chemical Survey of the Waters of Illinois. Report for the Years 1897-1902. By Arthur W. Palmer, Professor of Chemistry, University of Illinois, Champaign, Ill.

The work of this survey was divided into three parts for purposes of report, the sanitary condition of ordinary ground waters, mineral analyses of well waters mainly from deep wells, and the surface waters. The first and third of these subjects are included in this volume.

During the years covered by the survey 3,715 samples of water from various sources, surface and ground, and from artificial ice to sewage have been analyzed for individuals under the provisions of the law establishing the survey, all but two counties of the State being represented in the list. The methods of analysis used are described in detail and the meaning of the results is explained.

Prof. Rolfe has a paper on the geology of the State, as related to its water supply.

The sanitary and chemical examinations of the Illinois River before and after the opening of the Chicago main drainage channel form an important part of the report. Most of this information has already been printed in other reports concerning the drainage canal. The conclusions drawn by Dr. Palmer are that the Illinois River at its mouth was in many respects superior to the Mississippi prior to the opening of the canal, notwithstanding the sewage of Chicago, Peoria, Pekin, etc., discharged into it; that the quality of the Illinois River at its mouth is materially improved since the opening of the drainage canal, the actual quantities of organic matter discharged from the Illinois into the Mississippi having been reduced, although the quantities of organic matter discharged into the Illinois since the opening of the canal have been increased 30 per cent; the Illinois River waters are practically as well aerated as those of the Mississippi, where they join, and they do not mix thoroughly, the waters of the Illinois passing down near the east bank of the Mississippi.

More than half the report is devoted to the tables of results of analyses and the graphical representation of those from the Illinois River, thus putting the data into convenient form for easy grasp of their meaning.

University and State sustained a serious loss in the death of Dr. Palmer after the report was prepared and before it was issued from the press.

Index to the Mineral Resources of Alabama. By Eugene A. Smith and Henry McCalley. Geological Survey of Alabama, E. A. Smith, State Geologist, University of Alabama.

This pamphlet of 77 pages, with a number of handsome illustrations, gives a brief but clear statement of the known resources of the State, many of them as yet not utilized, regarding iron ores, manganese, bauxite, coal and limestones of various kinds. It considers in a special chapter the kaolins and clays, especially those suitable for making Portland cement. This chapter also lists and describes the various limestones in the State which are available in quality and quantity sufficient for cement manufacturing purposes.

A miscellaneous chapter considers gold, copper, graphite, mica and a number of other ores, also the building stones, including lime and sandstones, granites and slates. Sand and road making materials are also named and the possibility of valuable quantities of asphaltum, petroleum and natural gas is suggested.

Municipal Manual for the City of Altoona, Pa., for 1904-5. Compiled by W. J. Hamor, City Clerk.

This book is vest pocket size with 168 pages and in addition to the manual features heretofore described in this department contains a condensed statement of the city finances and statistics of the various departments, including the operations of 1903.

Ninth Semi-Annual Report of the Sewage and Water Board of New Orleans, La., to June 30, 1904. George G. Earl, Gen. Supt.

This report gives the summary of the financial operations of the first six months of 1904. The magnitude of the work before this board may be estimated from the fact that its balance of bonds and cash available for future work was on June 30, $8,510,472.12, and that about $1,303,303.30 is available for work begun in 1904

ORGANIZATIONS AND INDIVIDUALS

Indiana and Ohio Engineering Societies—Technical Meetings—Personal Notes.

Indiana Engineering Society.

The Indiana Engineering Society will meet in Indianapolis Jan. 12, 13 and 14, 1905. The program includes:

"Designs for Water Works," by Prof. R. L. Sackett; "Sewage," by Daniel Foley; "Resurveys of Land in Knox County," by J. S. Spiker; "Municipal Improvements Under the Artman Law," by John Finan, jr.; "A Modern Flouring Mill," by O. E. McMeans; "Farm Drainage," by L. S. Alter; "Design of Concrete Arches," by D. B. Luten; "The Pollution of White River from Muncie to Anderson," by W. D. Collins; also some data and photographs of the Boston Metropolitan Water System; "Some Incidents of the Surveyor's Life," by John W. Fawcett; "Agricultural Drainage Work in Indiana," by W. D. Pence; "Water Filtration," by Charles Brossmann, jr.; "The Present Status of Reinforced Concrete," by W. K. Hatt; "Pavements," by John W. Fulwider; "Generating Gear Teeth," by E. W. Kerr. Reports will also be made by the various standing committees of the society. There will be a social meeting either as a banquet or a smoker and if the weather permits an excursion to the Water Company's new filtration plant, which is now in operation, and its new engine, which is now running. There will also probably be a paper by F. A. W. Davis on the plant, illustrated with stereopticon.

Ohio Society of Engineers.

The annual meeting of the Ohio Society of Surveyors and Civil Engineers will be held at the Great Southern Hotel, Columbus, O., Jan. 23, 24 and 25, 1905. The program includes papers on the legal status of surveyors and engineers in Ohio, the co-operative topographical survey, sewage and garbage disposal, the state canal system, stream gauging, etc. The names on the program include Mayor R. H. Jeffrey of Columbus, Attorney General Wade H. Ellis, President Charles Hermany of the American Society Civil Engineers, Prof. C. E. Sherman, F. A. Barbour of Boston, Col. F. W. Morse of New York, Chief Engineer C. E. Perkins of the State Board of Public Works, R. W. Pratt, City Engineer L. A. Keith of Mansfield and County Surveyor J. H. Asher of London. An excursion will be made to the experimental sewage disposal plant of Columbus and to the Scioto storage dam. There will also be a social session in the form of a banquet or smoker. E. G. Bradbury, Columbus, O., is secretary.

Technical Meetings.

The next annual meeting of the National Electric Light Association will be held in Denver, Colo., in June, 1905.

The nineteenth annual convention of the National Brick Manufacturers' Association will be held at Birmingham, Ala., Feb. 6 to 11, 1905.

The twenty-seventh annual meeting of the Illinois Clay Workers' Association will be held at Champaign, Ill., Jan. 10 and 11, 1905.

The convention of the Iowa Brick and Tile Association will be held at Ottumwa, Ia., Jan. 18 and 19, 1905. L. W. Denison, sec'y., Mason City, Ia.

Chief J. T. Mertz of Akron, O., is organizing a state association of fire chiefs of Ohio.

The National Association of Manufacturers of Clay Working Appliances will hold a convention at Birmingham, Ala., Jan. 30 to Feb. 5, 1905. George Hartwell, sec'y., Plymouth Bldg., Chicago, Ill.

The Wisconsin Clay Workers' Association will hold a convention at Manitowoc, Wis., Feb. 2 and 3, 1905. F. Voght, sec'y., Milwaukee.

The second annual convention of the Association of American Portland Cement Manufacturers met in New York City Dec. 13 and 14. The Association has a membership of 50, representing an aggregate capital of over $50,000,000 invested in the cement industry, and controls the

production of more than 90 per cent. of the total output of the United States. The association agreed upon an advance in prices, but the consensus of opinion was that the advance should be gradual, so that at the opening of the season next spring the prices in effect should be not less than $1 per barrel at the mill. A sum was provided for the employment of special agents who will be sent to investigate the large export trade which may be obtained in South Africa and South America. Funds were also set aside for the exploitation of new uses for cement in its various forms. A committee was appointed to petition Congress to make reciprocity treaties which would aid in the development of the export end of this industry. A committee reported that uniform specifications for testing cement had been adopted by practically all of the engineering societies of the country. A committee was appointed to attend the Cement Users' Convention to be held at Indianapolis, Ind., Jan. 17, 18 and 19, 1905. Officers for the ensuing year were elected as follows: President, John B. Lober; vice-president, A. F. Gerstell; treasurer, Ernest R. Ackerman; executive committee, Charles T. Wobe, E. M. Hagar, T. H. Dumary, T. J. Brady, W. W. Maclay, H. S. Bassett, E. M. Young, W. H. Harding, S. B. Newberry, R. W. Lesley, W. R. Warner and D. M. McCool.

The second day's session was devoted entirely to the reading and discussion of the following papers: "Cement Testing," by W. Purves Taylor; "Irregular Method of Testing Cement," H. A. Schafer; "Some Further Investigations in Regard to the Constitution of Portland Cement," Clifford Richardson; "Reinforced Concrete," Charles S. Hill; "Cyclone System of Burning Powdered Coal," W. H. Stroud; "Laboratory Work at St. Louis," Richard L. Humphrey.

The third annual convention of the Illinois Electrical Association was held at Bloomington, Dec. 8 and 9. The association has 100 members and its object is to promote the welfare of the electrical contractors of the state.

The League of California Municipalities held a convention at Santa Ana, Cal., Nov. 17 and 18. Municipal improvements and oiled roads were discussed. Officers for the ensuing year were elected as follows: President, Mayor L. O. Stephens, Fresno; vice-presidents, J. J. Hanford, San Bernadino, and J. E. Brown, San Jose; secretary, H. A. Mason. Chico was decided upon for the meeting place of the association next year.

The first annual meeting of the National Association of Manufacturers of Sand-Lime Products was held at Cincinnati, O., Dec. 5 and 6. Officers were elected as follows: President, W. K. Squier, Syracuse, N. Y.; vice-president, Robert E. Dolan, Denver, Colo.; treasurer, Wiliam King, Cedar Rapids, Ia.; secretary, H. O. Duerr, Wilmington, Del. Among the papers presented were the following: "A Model Sand Lime Brick Plant," H. O. Duerr, Wilmington; "How to Get Sand-Lime Brick Before the Public," J. L. Jackson, Saginaw, Mich.; "Treatment of Lime After Hydration," W. K. Squier, Syracuse; "Methods of Manufacture," S. V. Peppel, Louisville, Ky.; "Silo Systems Sand-Lime Brick Manufacture," A. J. Johnson, Sioux Falls, S. D.; "Drying Sand," P. L. Simpson, Chicago; "Cost of Manufacture," J. S. Palmer, Sebewaing, Mich.; "Shall the Sand-Lime Brick Men Join the National Brick Manufacturers' Association?" W. K. Squier, Syracuse; "What Are the Brick and Other Trade Journals Going to Do For the Sand-Lime Brick Industry?" T. A. Randall and E. H. Defebaugh; "Advertising," H. De Joannis.

The annual meeting of the Western Society of Engineers will be held at Chicago, Ill., Jan. 3. J. H. Warder, sec'y., Monadnock Blk.

The annual meeting of the Michigan Engineering Society will be held at Lansing, Mich., Jan. 11 to 13. F. Hodgman, sec'y., Climax, Mich.

The Illinois Society of Engineers and Surveyors will hold its annual meeting at Chicago, Ill., Jan. 18 to 20. E. E. R. Tratman, sec'y., 1636 Monadnock Blk., Chicago.

The annual meeting of the Canadian Society of Civil Engineers will be held at Montreal, P. Q., Jan. 24 to 26. Prof. C. H. McLeod, sec'y., 877 Dorchester-st., Montreal.

The December meeting of the New England Water Works Association was held at Boston, Mass., Dec. 14. Charles F. Knowlton, water commissioner at Quincy, Mass., was appointed to fill the vacancy on the committee on rates for metered water, caused by the death of George P. Westcott of Portland. A paper describing "The Concrete-Steel Water Tower and Stand-Pipe at Ft. Revere, Hull, Mass.," was read by Leonard S. Doten, Civil Engineer to the Quartermaster's Department, U. S. A.

The thirteenth annual meeting of the New Jersey Sanitary Association was held at Lakewood, N. J., Dec. 9 and 10. The principal subjects discussed were malaria and mosquitoes, sewage disposal, medical inspection of schools, the control of communicable diseases and the sanitary protection of the milk supply. Officers for the ensuing year were elected as follows: President, Dr. James A. Exton of Arlington; secretary and treasurer, George P. Olcott, C. E., East Orange. The next convention will be held at Lakewood.

The committee on inspections of the Municipal Engineers of the City of New York arranged for an inspection of the shops and mills of the Passaic Steel Company at Paterson, N. J., on Dec. 10. Through the courtesy of the members of the company the mills and shops were to be kept in operation for a portion of Saturday afternoon for the benefit of the members of the society. E. McLean Long, C. E., 220 Broadway, was associated with the committee for this inspection. Wisner Martin, secretary.

At the meeting of the Municipal Engineers of the City of New York Dec. 28, 1904, Mr. Henry R. Asserson, Chief Engineer of the Bureau of Sewers for Brooklyn, presented a paper on chemical precipitation plants, contact beds and septic tanks as considered in a design for a portion of Brooklyn's sewers.

The American Society for Testing Materials has voted to increase its annual dues to $5, and has adopted the standard specifications presented at the last convention by its committees for cement, cast iron pipe and special castings, foundry pig iron, malleable castings and locomotive cylinders.

The fifty-second annual meeting of the American Society of Civil Engineers will be held at 220 W. Fifty-seventh-st., New York, Jan. 18 and 19, 1905.

At the annual meeting of the Brooklyn Engineers' Club, held Dec. 8, 1904, Richard S. Buck was elected president; Clarence D. Pollock, vice president; Joseph Strachan, secretary, and John Middleton, treasurer.

Civil Service Examinations.

The United States Civil Service Commission will hold examinations as follows:

Jan. 4 and 5—For three vacancies in the position of civil engineer student in the Department of Agriculture at not exceeding $50 per month; for the position of constructing engineer in the United States Power Depot at Dover, N. J., at $200 per month.

Jan. 18 and 19—For irrigation engineer in connection with the irrigation and drainage investigations in the office of experiment stations of the Department of Agriculture, with initial salary from $1,500 to $2,000 per annum; for inspector of mechanical and electrical engineering at $2,190 a year in the office of the supervising architect, Treasury Department; for assistant to the chief inspector in the Quartermaster's Department at Large, Schuylkill Arsenal, Philadelphia, Pa., at $1,500 per annum; and on Jan. 18 for the Panama canal for assistant civil engineer at $200, $225 and $250 a month; instrument man at $175 a month; transit man at $150 a month; level man at $100 to $125 a month; rodman at $75 and $83.33 a month; chainman at $60 a month and helper at $50 a month.

Personal Notes.

E. H. Smith has been appointed city engineer at Zanesville, O.

E. N. Chisholm has been elected city engineer at Columbia, S. C.

William C. Elliott has resigned as city engineer of Portland, Ore.

Hon. James P. Baxter has been re-elected mayor at Portland, Me.

Parker & Bateman, civil engineers of Clinton, Mass., have established a branch office in Ayer, Mass.

Emery D. Irelan, city clerk of Atlantic City, N. J., died December 2, of paralysis.

Ivan Smith of Plano, Ill., has been appointed county surveyor to succeed Orson Dolph, deceased, of Yorkville, Ill.

J. V. Brown, president of the Williamsport Water Company, Williamsport, Pa., died suddenly of heart disease December 8.

R. L. Keely has been appointed professor of mechanical engineering in the University of South Dakota, Vermilion, S. D.

H. Von Schon, M. Am. Soc. C. E., has moved his permanent headquarters from Sault Ste. Marie to Detroit, Mich., where he has established offices for consulting practice in the Wayne County Bank Building.

Edwin D. McCracken died at his home in Leonia, N. J., December 15, aged 66 years. Mr. McCracken had been engaged in electrical work the greater part of his life. The most important of his discoveries was the use of paper as insulation for underground cables, for which he received the medal of honor from the Franklin Institute of Philadelphia.

Charles E. Wells, M. Am. Soc. C. E., engineer of the reservoir department of the Metropolitan Water and Sewerage Board, has been appointed to a position with the U. S. Geological Survey.

Daniel McGrath, Buffalo, N. Y., died at his home in that city December 7, aged 57 years. Mr. McGrath had been connected with the Barber Asphalt Paving Company for the last eight years.

Prof. Harris J. Ryan, head of the department of electrical engineering, Sibley College, Cornell University, has accepted an appointment to the chair of electrical engineering of the Leland Stanford, jr., University, Palo Alto, Cal.

The Henry S. Spackman Engineering Company has removed its office and laboratories to 42 N. Sixteenth-st., Philadelphia, Pa., where they have increased facilities for general engineering and chemical and physical testings.

Nicholas S. Hill, M. Am. Inst. Elec. E., has opened an office for private engineering practice at 100 William-st., New York City. Mr. Hill resigned as chief engineer of the New York Water department on September 1.

E. Von der Osten & Company, consulting engineers, has changed its name to the Roncesvalles Engineering & Construction Company, and will conduct all business under that name with its head office at 243 Roncesvalles-ave.

O. A. Stranahan has been appointed manager of the power department of the Allis-Chalmers Company, and will have charge of the sales of reciprocating engines, gas engines and steam turbines. He will establish headquarters in Milwaukee.

Thomas H. McGraw, superintendent of the City Water Department of Dallas, Tex., met his death Dec. 2, either as the result of an accident or suicide. Mr. McGraw was fifty years old and had been connected with the water department for nineteen years.

Frank F. Rogers, Port Huron, Mich., whose contract as civil engineer to the Port Huron Engine & Thresher Company expired during December, will enter a general engineering practice in Port Huron, making a specialty of road and municipal work.

Freeland Howe, jr., chemist and bacteriologist, Norway, Me., has been engaged to put in operation and to conduct official tests on water purification plants which have been built recently in the cities of Gloucester, N. J.; Sunbury, Pa., and Monessen, Pa.

W. A. Waddle, manager of the Somerset Water Works Company, Somerset, Ky., died suddenly Nov. 27.

William S. Ide has opened an office in the Small Building, York, Pa., for general engineering work. Mr. Ide was formerly engaged on government engineering and lately with Messrs. Rudolph Hering and George W. Fuller and T. Tyrrell Heiges of the city engineering department of York.

A. O. Baker has resigned as superintendent of the electric light and water plants of Wellington, Kas., to accept a similar position with the Citizens' Heat, Light & Power Company of Wichita, Kas.

Joseph Seifert has been appointed superintendent of the municipal water works plant at St. Cloud, Minn., succeeding H. E. Stevens, who resigned to accept a similar position at Staples, Minn.

Frederick H. Lewis of Staunton, Va., has severed his connection with the Virginia Portland Cement Company at Fordwick, Va., and will spend some months in travel and recreation before making any new business connections. Mr. Lewis was appointed consulting engineer of the company about six years ago, and built its plant and town site and was then made manager of the company.

George S. Rice will succeed William Barclay Parsons as chief engineer of the New York Rapid Transit Railroad Commission. Mr. Rice has been closely identified with Mr. Parsons in working out the original schemes for rapid transit, and in 1900 he was appointed deputy chief engineer. Since that time he has acted as chief engineer, during the absence of Mr. Parsons, and has been in direct charge of the rapid transit work a great part of the time since 1900.

Mayor Jeffrey of Columbus, O., appointed, Dec. 14, the honorary park and boulevard commission, as follows: B. F. Pray, Fred C. Rector, W. E. Edmiston, George L. Ruggles, James Henderson, F. W. Schumacher, Frank C. Hubbard, Henry Maetzel, Charles R. Mayers, Henry M. Neil, J. Russell Kilbourne, Jesse C. Rowe, C. A. Miller, A. J. Pray, C. W. Gropp, Carl J. Hoster, George W. Lattimer and W. V. Baker.

A. H. Smith, Assoc. M. Am. Soc. C. E., has resigned as mechanical engineer of the Toledo, O., plant of the American Bridge Company and has established an office at 322 the Nasby, Toledo, where he will engage in a general, civil and mechanical engineering business, making a specialty of designs in steel and of the operating machinery for movable bridges.

MACHINERY AND TRADE

A Machine for Making Continuous Hollow Concrete Wall.

A Chicago company has recently placed on the market a machine for constructing a continuous hollow wall, the air space running from sill to plate and around the building, thus insuring imperviousness to moisture, heat and cold. The exterior wall can be made to represent cut stone in its various forms as easily as a plain surface and with no greater expense. The inside wall, supporting the floor joist, can be made thicker than the outside one, ledges being built as the wall progresses to give the joist proper bearing and still preserve intact the smooth interior air chamber. The machine forms the corners and angles of any kind for bay windows, and also finishes solid and tight around any window or floor openings. The wall is laid up in courses of about 12 inches, although higher or lower courses may be laid. The process is continuous, as by the time the machine has passed around an ordinary building the concrete will have set sufficiently so that another course may be started immediately, thus making a continuous and uninterrupted process until the work is complete. The inner and outer walls are bonded together at each course with reinforced concrete bridges or ties, which are cast simultaneously with the body of the concrete, thus insuring absolute rigidity.

The machine is in the nature of bottomless receptacles provided with removable or pivoted sides, between which concrete is received, formed, and held until set, and a portion of the wall of predetermined extent thus constructed. The apparatus is then detached from the molded wall sufficiently to be moved to a new position, whereupon another similar portion of the wall is molded. The sides or plates of which the machine is composed are four in number, two for the outer and two for the inner wall. The two plates, one of which forms the outside of the outer wall, and the other the inside of the inner wall are attached to the cross-frame by hinges, and held in position by a movable knee-brace. They are adjustable at any convenient distance from the two plates which form the two sides of the air space, thus providing for any width of inner or outer wall. The cross-frame is carried on two horizontal guides which in turn are carried on two vertical ones thus making it impossible for the machine to get out of line. Any finish may be given to the inner or outer wall by screwing molding boards to the inner sides of the plates forming the wall, thumb screws being provided for this purpose.

The machine has the advantage of not requiring expensive wooden forms or skilled labor for its operation and it promises to give concrete users an inexpensive means of building a hollow wall of that material. We are indebted to Mr. Hibbard of the Concrete Hollow Wall Construction Company for the oportunity of seeing one of the machines in operation in the construction of a cemetery vault at Elmwood Cemetery just outside Chicago. The address of the company is 1520 Ashland Block, Chicago, Ill.

Simplex Concrete Piling in Pittsburg Warehouse Foundations.

The Pittsburg Terminal, Warehouse and Transfer Company of Pittsburg, Pa., is constructing a group of thirty-eight six-story warehouses in the area between Third and Fourth-sts., Carson-st. and the Monongahela River. These buildings rest on 400 piers which are supported on about 4,600 concrete piles which were placed jointly by the Cranford Paving Company of Washington, D. C., the contractors for the foundations of the buildings, and the Foundation Company of New York City, the proprietors of the simplex system of concrete piling.

The heads of the piles are in shape much like a projectile for a great gun, are seventeen inches in diameter and thirty inches long to the shoulder, which is ten inches long. They are made on the ground in molds and are reinforced with expanded metal and six steel bars, which form a firm bond between the parts. These points are left for thirty

days or more to harden and are then driven with a piledriver hammer weighing 3,000 pounds, being followed by a steel cylinder to the depth of forty or forty-five feet necessary to put them where the last eight blows will not drive them more than half an inch each. This cylinder is filled with concrete three feet deep, is withdrawn two feet, again filled two feet and withdrawn two feet, each deposit of concrete being tamped with a steel hammer weighing 300 pounds. When the cylinder is entirely removed, the concrete pile is left in the ground complete and ready after hardening to receive the steel base on which the steel frame of the building will rest.

Thorough tests of the concrete piling were made before it was accepted for the foundation and it was found superior to wooden piling in strength and it has the additional advantages over other materials ordinarily used of durability, not rotting or being attacked by insects or worms, and securing increased compression of the earth displaced in the process of construction.

The Foundation Company, 35 Nassau-st., New York City, will supply any additional information about this use of concrete.

A Carrier for Street Cleaners.

A new carrier for the can or bag of the hand street cleaner has been placed on the market by the Wirt and Knox Manufacturing Company, 22 N. Fourth-st., Philadelphia, Pa. The accompanying illustration shows the carrier ready to receive either can or bag, no readjustment being necessary for change from one to the other. The frame of the cart is of tubular steel. the axle and can support are of steel. the platform and arm supports are of malleable iron and the wheels are wooden wheels of the best pattern, thirty inches in diameter. The appearance of the carrier is neat and it is light, strong, durable, convenient and serviceable. It has been endorsed by the department of street cleaning of New York City in the most practical manner by the purchase of the first 300 of the carriers which were made. Other cities are now considering it favorably and its introduction has been so fortunate that its merits should receive early recognition from all users of such apparatus.

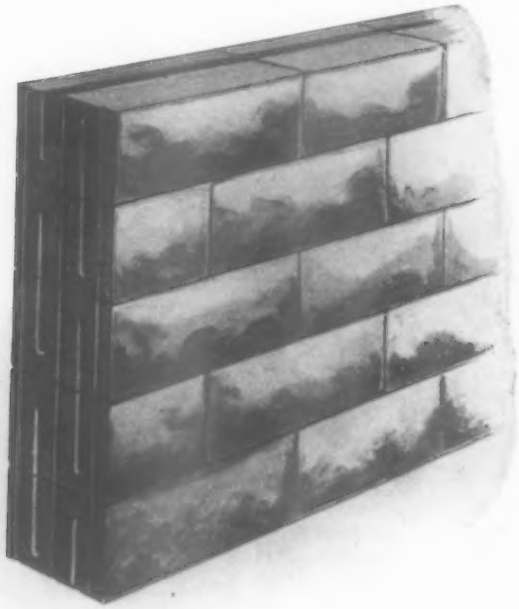
WIRT & KNOX'S BAG AND CAN CARRIER.

The Blakeslee Concrete Block.

The increasing popularity of cement or concrete blocks for building purposes has led the inventors' minds into new channels with the result that such slight objections as have heretofore been raised are being rapidly overcome.

One objection urged by some against this class of building material has been the tendency of the blocks to absorb moisture, necessitating the use of studding and lath on the inner face of a wall. The Blakeslee Concrete Block and Machine Company of Columbus, O., are now bringing into public notice a new and unique building block which, in addition to being constructed in substantial form, is said to be absolutely moisture proof, in the sense that moisture does not reach the inner wall surface. The Blakeslee block differs materially from the class of "hollow blocks," and as shown by the

illustration, is constructed with two longitudinal grooves or recesses so arranged as to prevent the formation of a continuous solid portion at any point from front to rear. This plan of construction not only provides the desirable air spaces in the wall but operates to prevent moisture from passing through the block. This block, which is the subject of broad patent claims in itself, is produced on a machine of such simple construction as to admit of its operation by an unskilled person. This machine is also the subject of an allowed patent which, as well as the block patent, is owned by the Blakeslee Concrete Block and Machine Company.



BLAKESLEE SYSTEM OF CONCRETE BLOCK CONSTRUCTION.

The Blakeslee block machine sells at such a low price as to enable builders of ordinary means to own their own block machines.

This company has not been long in the field but the advantages of both its block and machine are being recognized on all sides. The offices of the company are located at Columbus, O. It will have an exhibit at the convention of cement users to be held in Indianapolis in January.

Sterling's Universal Concrete Block Machine.

One of the latest additions to the list of hollow concrete block machines is the Universal, which with the blocks, trucks and tracks and system of building has been patented by William J. Sterling and is now put on the market by the Universal Concrete Machinery Company of Norfolk, Va.

The machines are made in three different sizes. The "Virginia," is said to be the largest machine on the market and can turn out 300 blocks in 10 hours, producing sills, lintels, columns, caps, etc., on the same machine as the regular blocks and in all desired sizes. Several blocks of the same or different sizes and designs can be made at one time. Power can be applied to the machine if desired.

The "New York" machine can make 125 blocks a day. The "Indiana" machine has a capacity of 100 blocks a day and is designed as a low priced machine, most valuable to contractors and others not engaged extensively in the manufacture of concrete building material but wishing a machine to turn out good blocks in

sufficient quantity for the demands of their trade.

All these machines deliver the blocks down through the bottom of the machine and deposit them on the "Jamestown" truck and track system, whereby they are carried out to the curing shed without handling by manual labor from the time the material is tamped into the mold. This truck system is an important part of the system of operating a concrete block plant.

The blocks are made in the machines with the face down so that they have the most perfect impression of the face design which can be obtained and the surface is most thoroughly compacted. Blocks of all thicknesses can thus be made on the same size pallets, thus materially reducing the number of these important pieces of apparatus necessary to have about the plant. The forming cores of the Universal machine part in the middle, are tapered and draw out sideways, leaving an annular ridge centrally of the opening in the block, giving it greater strength in the middle. There is no bolting or unbolting of sides of mold or taking them off, and no lifting of the block over the machine. One man can discharge the finished product from the machine on to the delivery track.

A two-piece wall block is also made, called the Universal Interlocking Block, having means of locking the blocks together so as to prevent lateral movement. The corners of a building are well taken care of with these blocks, which can also be used for veneering.

The Universal Concrete Machinery Company, Norfolk, Va., can give full detail of the machines and processes.

Sand and Cement Formula.

The Western Brick Company of Keokuk, Ia., lay particular stress on the fact that their Bowen Chemical Formula enables contractors in sand and cement to continue their work in the making of brick or building blocks even when the thermometer registers below zero. Heretofore when the winter season approached the contractor put up his tools for his season of work was over. But now, with the use of this chemical formula, the contractor makes his brick or building block, etc., in coldest weather and thus prepares himself for spring construction work, or in mid winter works and builds without interruption. This chemical mixture is sold at $4 per case. It is put up by Mr. Bowen himself, who is manager of the Western Brick Co., of Keokuk, Iowa.

A Concrete Block Building on a Cut Stone Design.

The accompanying picture of the Nebraska State Normal school building at Kearney, shows a building designed by the architect for construction in cut stone but which has actually been constructed of concrete building blocks made on the machines of the American Hydraulic Stone Company, Denver, Colorado, by the Nebraska Hollow Wall and Concrete Company.

About 50,000 square feet of wall surface are required for the building. The main walls of the basement, first and second stories are 13 inches thick and the third story is 9 inches thick.

To carry out the specifications it was necessary to manufacture blocks varying in length from 6 inches to 60 inches, and meeting all these demands with these machines.

The contract for this building, using the finished, or "faced" block for all exposed work, was $2,000 less than the lowest bid for common brick; $5,000 less than for common brick with pressed brick face, the pressed brick to extend only through the front and end returns of ten feet; and about $15,000 less than for common brick with a 4-inch veneer of Bedford stone, the Bedford stone to be used only for front and returns of 10 feet on each end.

The ornamental work, such as bases, capitals, columns and pilasters, is made in the following widths (in inches) of courses: 7¼, 8¾, 9, 9¼, 10, 10¼, 10½, 11¾, 14¾, 20¾, 21 3-16, 22¼ and 22¾.

The blocks up to 11¾ inches in width were all made in the regular combination mould, while those of greater width and in excess of 24 inches in length were made in a special mold 24 by 60 inches. When it is understood that the above 13 different widths of courses were made for both the outside walls and inside partitions (there being six different thicknesses of walls and partitions in this building), the adaptability of this system for making blocks will be appreciated.

One of the difficulties in concrete block construction is found in meeting the demands of architects and of designs made for other materials, but the construction of this building shows the possibility of

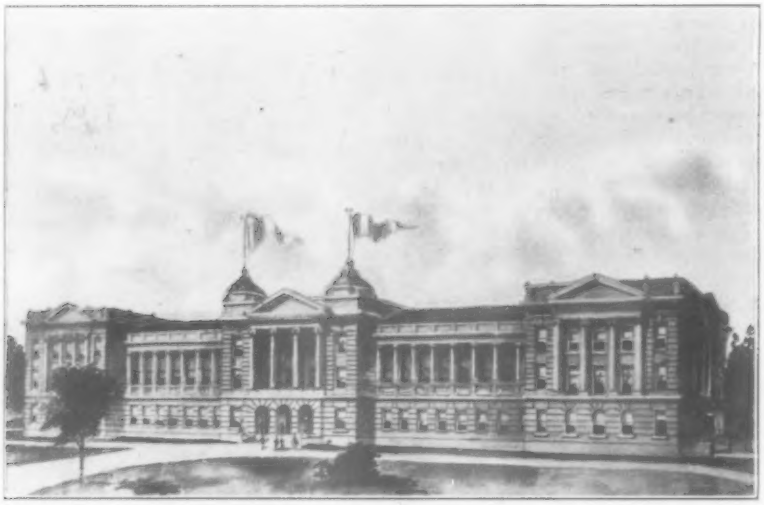
of concrete on the ground at a cost not exceeding 25 per cent. of the price of terra cotta.

The American Hydraulic Stone Company's system uses coarse wet concrete under heavy pressure which is believed to make blocks as heavy and as strong as it is possible to make them with a given mixture of cement and aggregates. It is evident also that the machinery is adaptable to great variety of construction and dimensions.

A Gold Medal for the Normandin Concrete Block Machine at St. Louis.

The Cement Machinery Company of Jackson, Mich., manufacturers of the Normandin machines, met with great success at the Universal Exposition, St. Louis, Mo. Three of their latest style Normandin cement block machines were on exhibition—two in the Mines and Metallurgy Building and one in the mining gulch. These machines were all in charge of competent experts and demonstrated to over four thousand people from every State in the Union and nineteen foreign countries. The company is said to have been the first company manufacturing cement block machines to have its exhibit completely installed and doing business. The Normandin machine was the first block machine reported as sold at the Universal Exposition. At the close of the Fair the cement machinery exhibit was completely dismantled and all three machines which were on exhibition were disposed of at the regular price to different parties in St. Louis, Mo.. A large number of Normandin machines have been sold and many new block companies organized through this exhibit by the representatives in charge of same.

Announcement has been made that a gold medal has been finally awarded on this company's exhibit of hollow concrete block machinery and that a medal and diploma for this award will be issued as soon as ready for delivery. This machine will be on exhibition at the Indianapolis convention of cement users in January.



NEBRASKA STATE NORMAL SCHOOL.
Constructed of American Hydraulic Company's Concrete Blocks.

Gold Medal for Bitulithic.

The World's Fair Jury of Awards, in the group of social economy, which comprises street pavements, has just granted to Warren Brothers Company of 93 Federal-st., Boston, Mass., a gold medal, the highest award, for its form of street pavement, and the Superior Jury confirmed the award without dissent. The pavement for which the gold medal was awarded is known as the Bitulithic, or Bituminous macadam pavement, which is laid on Lindell-boulevard and many other streets in St. Louis.

In the competition for the award, prac-

tically every system of pavement now in use, including brick, macadam, wood and asphalt, was entered. The jury visited and carefully examined each kind of pavement represented in the construction of the streets of the Model City, and also examined and studied the various forms of pavements laid on the streets in the City of St. Louis, including an investigation of materials, methods of laying and process of manufacture. As a result, the gold medal was awarded to Warren Brothers Company

BITULITHIC PAVEMENT ON LINDELL BOULEVARD, ST. LOUIS.

of Boston. In this connection it may be said that a short time ago M. Gerald, Commissioner General of France to the World's Fair, carefully inspected Lindell-boulevard, which is paved with the Bitulithic pavement by the Granite Bituminous Paving Company, which also laid the Bitulithic pavement in the Model City, and declared that it was the best paved street he had seen anywhere, and would be a credit to Paris or any other city. The accompanying photograph shows a view of this street as paved with the Bitulithic pavement.

The "Modern" Cement Building Block Machine.

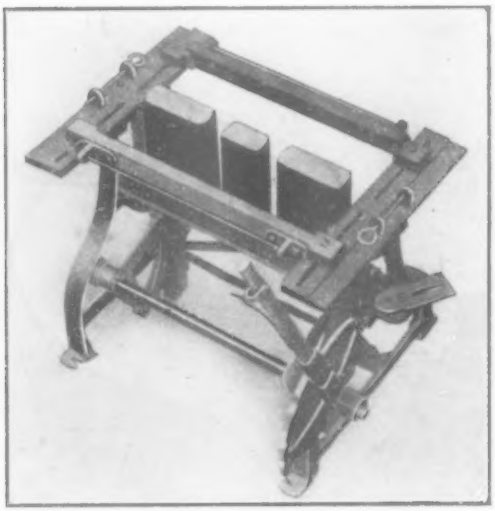
The "Modern" cement building block machine, shown in the accompanying cuts, is simple in construction and has many features not generally found, such as the hinging of the doors and especially the manner of fastening them when molding the block. This is done by means of a cam clamp that is very simple but positive, and can be easily and quickly adjusted, and when the doors are closed and the clamp applied they are held perfectly close and firm and are then instantly released.

Another feature of this machine is the arrangement for making an "L" block that is rock faced on the interior angle, which operates in the most perfect manner. The arrangement for making angle blocks is such that it can be changed from one angle to another in a very short time; in fact the machine can be changed from one style of block to any other in a very few minutes. Circle blocks of any radius can be made and

rock faced either side or both for circular porch or tower work.

Perhaps the most valuable feature is the arrangement of extending the bed plate so that any width of block can be made from six to twenty-four inches, as is shown in the cut. The same side doors can be used and only extra ends doors are required to make blocks of any desired width.

The J. D. Fate Company of Plymouth, O., has spent much time and money in making the "Modern" a perfect machine for molding these blocks and will be pleased at any time to send to any one a catalogue fully describing their machine and give all the information possible in regard to the machine and also the making of the blocks. One of the cuts referred to accompanies this article and another will be found in the company's advertisement, to be found elsewhere in this number.



THE "MODERN" CONCRETE BLOCK MACHINE.

Brady Concrete Blocks Made Under Pressure.

The Brady Cement Stone Machine Company, 430 N. Jackson-st., Jackson, Mich., has recently put on the market a machine for making concrete blocks under pressure. Sizes range from 2x2x6 inches to 9x18x60, and all sizes up to 8x9x60 permit two blocks to be made in the machine at one operation.

The face of the block is formed on the upper surface in the machine and it is thus possible to use a backing for the stone of say 1 cement to 6 sand and a face of 1 to 2, of different sand, if desired, and to get the natural effect of cut stone of any design on the face.

The 1905 catalogue of the manufacturers gives full description of the method of operation of the machine and shows clearly its special advantages.

Cement Shingles.

The difficulties with roofing cause many to ask what has been done in the way of applying cement to the manufacture of roofing materials. The United States Cement Shingle Machinery Company of Saginaw, Mich., offers a solution of the problem in its reinforced cement shingles, hip shingles and ridges.

The process of making the shingles in the machine is continuous. The iron molds are carried on a moving belt and as they pass along they receive first the bottom boards, then the reinforcing wires, then, in the machine, the filling and the compression and a trowel finish to produce a glazed surface. They are then placed in shelf racks for thirty minutes, when, the shingles being set sufficiently, the molds are removed and again started on the round. The shingles remain on the bottom boards for twenty-four

hours and are then stored on edge in the storage yard. A machine will turn out from ten to twelve squares a day.

The wire reinforcement terminates in projecting loops on each side by which the tiles are nailed to the roofing boards. The shingles are a half-inch thick at the butt, are slightly tapered and can be made of any width, shape or color. They are said to weigh about the same as slate and are shipped in the same manner. Special forms of hip and ridge shingles are made for use in valleys, ridges or any portion of a broken roof.

The advantages of cement shingles over wood on the one hand and slate on the other are quite evident. This company will have an exhibit at the Indianapolis convention of the National Association of Cement Users, Jan. 17, 18 and 19.

Collapsible Sewer and Arch Centering.

An important item in estimating the cost of building large sewers or archways has always been the expense of preparing and setting up a framework around which the masonry is placed, principally on account of the large quantity of lumber and skilled labor required in advance of sewer construction.

In order to provide a substitute which combines simplicity of construction with economy in operation, an apparatus has been invented and patented by B. H. Muehle, a civil engineer of Detroit, Mich. It is built in sections, each composed of three parts, all clamped or bolted together end to end so as to form a continuous framework upon and around which the concrete, brick or stone masonry may be placed in the usual manner. When the concrete or masonry surrounding one section has sufficiently set to bear its own weight the component parts of this section of centering may be separated and assembled upon a truck or carriage, then passed through the adjoining section and set up again at the other end, thus alternately collapsing and erecting the several sections so that the concrete or masonry construction may be carried on uninterruptedly.

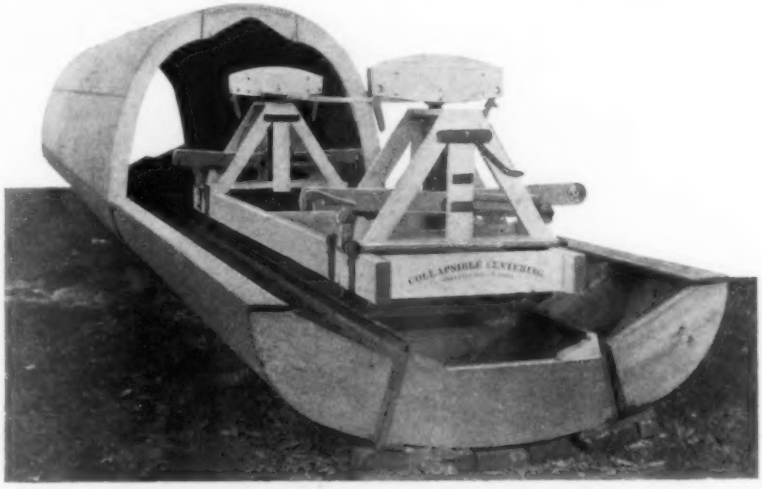


FIG. 1. MUEHLE CONCRETE SEWER FORM.
Showing Complete Outfit of Forms and Truck.

A complete outfit consists of three sections of foundation frames or molds, each twelve feet long, composed of three parts each, two sections of arch frames or molds, also composed of three parts each, and one truck or carriage, as shown in Fig. 1. The line of contact between the first two sections is indistinct in the cut. For more rapid construction as many complete sections of centering frames may be added as are required to give time for the setting of the masonry. One carriage only is needed. Its mechanism is simple in construction and may be operated by one attendant at each end, who disconnect the several parts of each section, attach them to the mechanism of the carriage, then collapse and assemble

them in contracted form and pass them through the adjoining set-up section.

Fig. 2 shows the car running on the track which is a component part of the foundation frames, and passing through a section of the frames set up ready for the masonry to be laid. The car is loaded with the three parts of an arch section which have been separated and packed into space contracted enough to permit passage of the loaded car. By reversal of the operation of the machinery on the car which handles the section the parts are reassembled in their expanded shape and placed in contact with the section already erected, to which they are then attached.

The outer shell or sheathing of this centering apparatus is formed of galvanized iron or steel, and the frames or ribs may also be made of iron to insure rigidity and strength.

FIG. 2. MUEHLE CONCRETE SEWER FORM.
Showing Knocked Down Form on Truck Passing Through Form in Place.

The patentee has organized the "Collapsible Centering Construction Company," with headquarters at Detroit, Mich., for the purpose of supplying contractors with outfits specially designed for sewers or archways of any size or shape.

Waterproof Cement.

The announcement is made that the "Star Stettin" Portland Cement Works, long known as making one of the best German cements offered on the American market, has begun the manufacture of a waterproof cement, which will shortly be offered for sale in America by Mr. E. Thiele, 99 John-st., New York City.

The process was invented in Germany and the claim is made for the product that, even when mortar is made in proportions of 1 cement to 6 sand, the work will become impervious to water and will resist frost, heat, hot water, sea water and diluted acids. It is also said that the surfaces of such work will not be disfigured by crazing, hair cracks or efflorescence.

These qualities seem to be secured without departing from the requirements made of a high-grade Portland cement as regards fineness, strength, durability, constancy of volume, uniformity in color, etc.

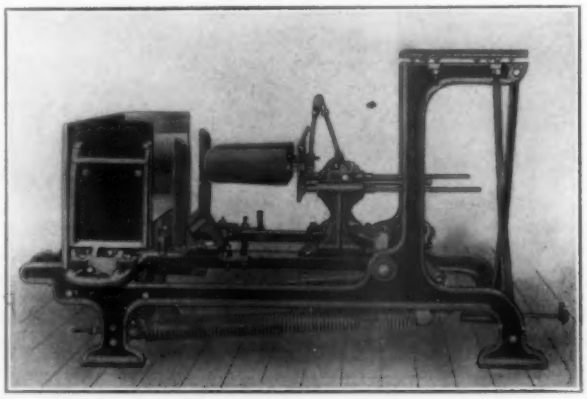
These are large claims and indicate that some of the difficulties met with by cement users are in fair way of removal. The high standing of the German manufacturers and of their representative in American markets give much weight to these claims and the action of the cement in practical work under American conditions will be watched with great interest by every cement user.

Fence Posts That Will Make a Fence.

The Cement Specialty Company of Detroit, Mich., is engaged in the installation of plants for the manufacture of concrete articles of various sorts, such

as blocks and posts. Any size and capacity of outfit from one costing $50 to one costing $5,000 will be constructed according to the needs of the purchaser. Complete outfits include machines which give proper proportions of sand and cement or sand, gravel and cement automatically; power tampers; power and hand self-cleaning mixers and molds for making blocks, posts, etc. In such a plant everything from measuring of materials to storing finished product can be done by machinery. Smaller outfits reduce the amount of power machinery according to the demand for reduction in first cost and capacity of plant.

The company makes a special reference to the cement fence post which it controls. It has the distinct advantage that a board, wire or other fence can be nailed or stapled to it the same as to a wooden post, and the further recommendation of low cost, the claim being made that it can be made for 12 cents and sold for 40 cents.



THE AUTOMATIC CONCRETE BLOCK MACHINE.

The Automatic Concrete Block Machine.

Another new applicant for favor in the field of concrete block construction is the machine made by the Automatic Concrete Building Block Machine Company, of Jackson, Mich., a drawing of which accompanies this article. The machine is easily adjustable to make different sizes of hollow and solid concrete blocks. It has no parts to handle, such as cores to draw or plates to remove. The block is delivered automatically to the landing table without touching the core or any plate, by simply raising the swinging frame.

The machine makes block of any length from 3 to 24 inches and makes them, 4, 6, 8, 10, or 12 inches in thickness.

The block is made face down, thus giving the face the full advantage of all tamping, and giving it the greatest density possible.

The company has recently installed a block manufacturing plant at Jackson with an outfit consisting of a 10 horsepower gas engine a 6 by 6 Franklin air compressor, a Boyer pneumatic rammer for compressing the concrete in the molds, an air hoist with 2-inch cylinders and 48-inch lift, a Smith mixer, 20 trucks holding 40 blocks each, and one automatic building block machine.

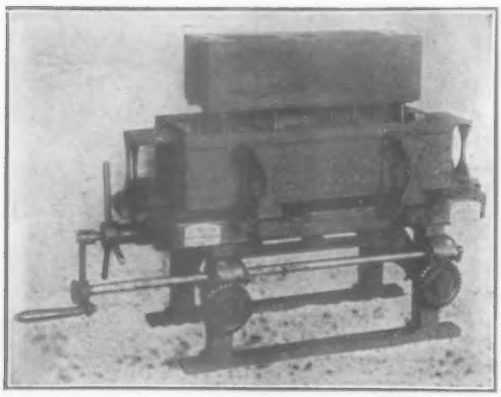
With this outfit five men can deliver in the curing shed ranked up for proper wetting 400 of the largest size blocks, 8 by 12 by 24 inches in dimensions, in 9 hours. The labor cost, including fixed charges is 3 cents a block for this output. The addition of one more block machine and air hoist will increase the capacity of the plant to 800 blocks a day and reduce the labor cost to 2 cents a block. Two men at the machine deliver the 400 blocks to the landing table in 9 hours or 800 solid veneer blocks from 4 to 6 inches in thickness and up to 24 inches in length.

The company also handles Miller's face-plate dressing, which when applied to iron or wood and allowed to harden makes the surface smooth and prevents adherence of concrete to it. This preparation can be used in any mold.

The Wilson Building Block Machine.

A new machine for making concrete biulding blocks on which claims for patents have been allowed is the F. F. Wilson building block machine, which is manufactured by John Mulstein, 209-217 Third-ave., Brooklyn, N. Y.

The machine consists of top box or table frame, two pairs of legs and lifting arms. The mold consists of two side plates and two end plates, arranged to slide on the bed plate. The axes of travel of the two pairs of plates are at right angles to each other and the plates are maintained accurately by brackets fastened to the side and end slides, so that all sides of the mold can be opened. The movement is made by means of bars, levers and a screw in the box or table.



THE WILSON CONCRETE BLOCK MACHINE.

The cores are carried by a frame which can be raised or lowered in the mold box by means of eccentrics. The shaft for operating the cores passes through the screw for operating the side and end slides. The finished stone is raised on a bottom plate, which rests on the base of the mold, and is engaged by a number of lifting rods projecting up on each side. These rods engage a frame which is raised or lowered by the swinging arms which engage rolls at the end of the frame. On one side of the machine is a pair of worm wheels incased in a metal box.

The machine with its attachments makes blocks from 6 to 28 inches in width, from 12 to 50 inches in length, and any depth up to 14 inches. There are no gears and the movable parts are all inclosed. Ends, sides and cores are adjustable and the machine is self-locking. In addition to the regular hollow or solid building blocks it will make keystones, lintels, window sills, steps and blocks of any design or shape within its limits of size. It is simple, strong and practical and has a capacity of 150 blocks in ten hours with three men.

Sand Lime Brick at the St. Louis Exposition.

The H. Huennekes Company, 114 Liberty-st., New York City, received the highest award in its class at the hands of the jury of awards for its exhibit of sand-lime brick and methods of manufacture of the same.

Trade Publications.

The Marinette Gas Engine Company, Chicago Heights, Ill., have issued a handsome descriptive catalogue of the Walrath gas and gasoline engines which shows the advance made by this engine in gas engine practice, gives descriptions of the features of the design of the engines and shows installations of the engines for water works, light and power plants, printing offices, hotels, etc., comparisons of efficiency with other heat engines and tables of power and duty. Other circulars about the engine have the suggestive title, "Gas Work vs. Guesswork," and "The Full Dress Gas Engine.

The Concrete Block Machine Company, Auburn, Ind., issues a catalogue

of the Model concrete building block machine.

Catalogue No. 30 of the Jeffrey Manufacturing Company, Columbus, O., describes the Schoellhorn-Albrecht patented pulverizing machinery which is now manufactured by this firm.

The American Hydraulic Stone Company, Century Building, Denver, Colo., issues an edition of its booklet on "Cement Building" dated November, 1904, showing pictures of hotel, State normal school building, apartment house, office building, cottage, factory, etc., built with their blocks, with illustrations of machinery and methods of construction.

The Underwood Building Block Machine Company, Fostoria and Columbus, O., sends a catalogue of the Underwood ventilating building blocks and machine for making them.

The American Road Roller Company, 156 Fifth-ave., New York City, sends a neat little catalogue descriptive of the Oastler double cylinder standard steam road roller, weighing ten to fifteen tons, the American, weighing ten tons, the general purpose, weighing six to nine tons, traction engines, combination traction engine and road roller. Oastler street sweeping machines, road and pavement scraper, star crusher, sanding wagon, can carrier and water wagon, making a full line for street making, repairing and cleaning.

The Chicago office of the Miracle Pressed Stone Company, Fisher Building, issues a neat and convenient circular describing and illustrating very clearly the manufacture of blocks in the machine, the full outfit necessary and various forms and faces of blocks. This company will be fully represented at the convention of Cement Users in Indianapolis, Jan. 17, 18, 19, 1905.

Keith's Triumph Cement post is illustrated and describe in a circular issued by J. M. Keith, Des Moines, Ia. Other circulars show the Crouch system of hollow concrete block constructions, hitching posts and wire straightener, controlled by J. M. Keith & Co., 1189 Fourth-st., Des Moines, Ia.

The Noyes F. Palmer Manufacturing Company, 150 Snediker-ave., Brooklyn, N. Y., issues a series of reproductions of editorials, articles and letters on concrete block construction and concrete block architecture, which should aid much in disseminating the idea that excellence of construction is what must be aimed at rather than cheapness. They will be sent on application.

The cement department of the Illinois Steel Company has printed and issued in cloth binding the report of the committee of the American Society for Testing Materials on "Standard Specifications for Cement," which the recent adoption by the society as a result of a letter ballot, makes authoritative. It issues in the same form a reprint from Buel and Hill's "Reinforced Concrete" on the subject of "Facing and Finishing Exposed Concrete Surfaces."

Horace See, 1 Broadway, New York City, sends a circular and blue print showing his pneumatic siphon hydrant which is said to fight frost and water-hammer successfully.

Gurley's Manual of the principal instruments used in American engineering and surveying, thirty-seventh edition, has been received. W. & L. E. Gurley, Troy, N. Y.

The C. O. Bartlett & Snow Co., Cleveland, O., in its special gear catalogue No. 10, gives a price and ordering list with full dimensions of its spur, bevel, miter and worm gears and illustrates its systems of cable haulage and belt conveyors.

Roberts & Schaefer Co., consulting and contracting engineers for coal plants of various sorts, issues a catalogue of coal washing machinery which also illustrates plants constructed under the supervision of the company.

Trade Notes.

ASPHALT.

Sealed bids are asked at Omaha, Neb., until Jan. 13, for a municipal asphalt repair plant. Andrew Rosewater, chmn. B. P. W.

The General Refining Company, Beaumont, Tex., is a new corporation which is the outgrowth of the Central Asphalt and Refining Company of Beaumont. About $500,000 of Memphis (Tenn.) capital is interested and controls the new company. The officers of the company are: President, Gen. S. T. Carnes; vice-president and general manager, T. H. Bass; secretary and treasurer, L. F. Benckenstein.

An ordinance was passed Dec. 2 at New Orleans, La., directing the City Engineer to prepare plans and the Comptroller to ask for bids for a municipal asphalt repair plant. Martin Behrman, Mayor.

BRICK.

The Wabash Clay Works, Veedersburg, Ind., has just closed the most successful

season in the history of its plant. The plant was opened in the spring of 1902, and started with eleven kilns, and every year since new kilns have been built until the plant now has twenty-five. The output for the present year has been about 1,500,000 paving brick.

The Millville Filtration Sand and Brick Company, Atlantic City, N. J., has been incorporated by Harry C. Baney, Charles A. Idler and Charles B. Wilson.

The Berkshire Pressed Brick Company, Springfield, Mass., has been organized and will manufacture brick by the Huennekes process.

The United States Brick Corporation has been incorporated at Washington, D. C., by Lorenze G. Warfield, L. J. McGee and Robert G. Warfield.

CEMENT.

Speed & Co., who own the large cement mill near Sellersburg, Ind., are constructing a spur from their mill on the Pennsylvania line to St. Joseph, in the western part of the county, in order to reach extensive shale beds in that vicinity. It is believed that the company will manufacture Portland cement.

The Consolidated Cement and Supply Company, Milwaukee, Wis., has been incorporated by R. G. Nashold, R. J. Penny and Thomas B. Cowen, all of Milwaukee. The company has not announced its plans, but it is believed that a cement plant will be operated near Milwaukee.

The erection of a Portland cement plant near Seattle, Wash., is contemplated by W. W. Butler of Seattle and H. Miller of Detroit, Mich.

The Louisiana Cement and Lime Company, New Orleans, La., has been organized for the purpose of purchasing the property rights and contracts of the Louisiana Lime Company of the town of Borgnemouth, and to build a Portland cement plant. The new company is composed of New Orleans and Pittsburg capitalists, and the officers are as follows. President, William J. Kelly; vice-president, William A. Lombard; treasurer, Robert A. Warriner; secretary, Matthew Warriner. The contract for constructing the plant has been awarded and it is expected to be in operation in six months

The Righter-Marshall Company, Mineola, N. Y., has been incorporated to deal in cement, coal and coke, by Walter L. Righter, Greenwich, Conn.; Wilbur A. Marshall, Plainfield, N. J.; Brian Evans, Manhattan.

The Kosmos Portland Cement Company, Louisville, Ky., has been incorporated by Sam Horner, Robert Horner and Anna McCracken, all of Philadelphia. The company will acquire land and plants for the manufacture of cement and kindred products, and is to enter every branch of the cement business. The plant is to be located just beyond the city limits of Louisville, at Riverview P. O., Jefferson County.

The Mississippi Valley Portland Cement Company, composed of residents of Chicago, has been incorporated at Dover, Del.

CONCRETE BLOCKS.

R. M. Wigton of La Grange, Ind., has purchased a cement block machine and will manufacture cement blocks.

The Marion Concrete Post Company, Marion, O., has been incorporated by J. F. Prendergast, E. H. Durfern, W. E. Scofield, J. E. Fairbanks and O. Wallenwaber.

Clarence Howard and W. L. Samuels, Jeffersonville, Ind., have formed a partnership and will engage in the manufacture of cement building and paving blocks. A plant will be established.

The Mulford Pressed Stone Company, Minneapolis, Minn., has been incorporated and will manufacture concrete building and paving blocks, fence posts and oranmental columns, by Benjamin W. Mulford, Henry Mayer and Philip J. Riordan, all of Minneapolis.

The Normandin machine, manufactured by the Cement Machinery Company of Jackson, Mich., has been awarded a gold medal for superior excellence by the Universal Exposition at St. Louis.

The Keystone Pressed Block Machine Company, Washington, D. C., has been incorporated by W. S. Hughes, R. S. Knapp and M. B. Knapp.

The Crookston Brick and Tile Company, Crookston, Minn., will add cement blocks to their output.

The establishment of a cement and concrete building block plant at Wausau, Wis., is contemplated by George L. Smith.

A plant will be erected at Pocahontas, Ia., for the manufacture of cement building blocks and tiles, by J. M. Burrington.

The Balzar Artificial Stone Company, Des Moines, Ia., is operating a plant.

Crumbe & Son, New Albany, Ind., may purchase additional concrete block machines, according to press reports.

Metchley Bros., Emporia, Kas., have put in operation a plant for manufacturing artificial cement stone and brick.

The Never-Rot Fence Post Company, Westerville, O., has been organized and a plant is being built. R. P. Bennett is patentee and general manager.

The Bryan Cement Company, Bryan, O., has been organized to manufacture building blocks, fence posts, mail box posts, etc.

A company has been organized for the manufacture of cement blocks at Clay Center, Kas., by Messrs. Slade, Lindner, Miller and Myers.

The De Witt Hollow Well and Construction Company, Lincoln, Neb., has been organized by Charles H. Bucks, William Sperling and W. C. Springer.

Spiess & Son, Fairfax, Minn., will manufacture cement blocks this winter.

The Wild Rose Cement Block Company, Wild Rose, Wis., has been incorporated by J. C. Proce, F. M. Clark and others.

The Eau Claire Concrete Company, Eau Claire, Wis., will commence operations

at once in the manufacture of concrete blocks in a temporary building, and will establish a permanent building in the spring.

A new cement block machine is being set up by Charles Fox at McPherson, Kas.

A company has been organized at Enterprise, Kas., by Hoffman Bros. and Riddell Bros., for the manufacture of concrete stone, and will be called the Kansas Concrete Stone Company. A warehouse will be built at once and machinery put in.

Stevens & Griffin, Hutchinson, Kas., have purchased property and will establish their plant for manufacturing cement blocks for foundations and building purposes.

The Becker County Stone and Tile Company, Detroit, Minn., has been organized by G. C. Nunn and D. S. Whittemore, who will engage in the manufacture of cement blocks.

The H. S. Palmer Hollow Concrete Building Block Company, Washington, D. C., has secured the contract for erecting the water works building at Charlotte, N. C., of hollow blocks. Several thousand barrels of Old Dominion Portland cement will be used in the construction of the work, and the building will cost more than $18,000.

The P. B. Miles Mfg. Company, manufacturers of the Miles Concrete Building Block machine, advises us that the increase of work during the last month demanded larger quarters and the company has, therefore, moved the offices to Room 23, Dwight Building. The work of manufacture will be continued in the old machine shop in their old location.

PURCHASE OF MACHINERY.

Bids are asked by the bureau of supplies and accounts, Washington, D. C., until January 24, for furnishing at Navy Yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of trucks, concrete mixer, hoisting engines, winch, air compressor, knife grinding machine and wood trimmer. H. T. B. Harris, paymaster-genl.

The American Panama Construction Co. has been incorporated at Trenton, N. J., to do all kinds of construction work, making a specialty of reinforced concrete work, bridges, buildings, etc., in Central and South America and in the Republic of Panama. The company expects to use large quantities of cement and contractors' machinery, and desires catalogues. Address American Panama Construction Co., Acon P. O., Canal Zone, Panama. All mail matter addressed to the Canal Zone, Panama, is carried at the United States domestic rate.

We have been advised by the following people, during December, that they are interested as possible purchasers in machinery and tools, as follows:

Bedford & Nugent, River Front, ft. of Division-st., Evansville, Ind., cement blocks and cement shingles.

W. J. Littlejohn, Seneca Falls, N. Y., small crusher, small mixer and water table and sill outfit.

Artesia Stone Co., Artesia, N. M., new or second-hand 8-inch plates for Chicago machine, manufactured by Cement Mfg. Co., Burlington, Ia.

Peter Helfrich, Spencerport, N. Y., cement block machinery.

Joseph F. Oilbacher, Elizabeth, N. J., cement block machinery and concrete mixers.

D. M. Click, South Omaha, Neb., building block and post machine, tile M C mixer.

Boys' Industrial Home, 617 E. Third-st., Williamsport, Pa., cement mixer, cement workers' tools, engine and boiler.

O. A. Dever, Cassopolis, Mich., mixer.

C. A. Owens, Owen, O., stone crushing and grain elevating machines.

W. H. Boyd, Jamaica, Ia., cement building block machine, cement fence posts, cement tile.

Gem City Concrete Block Company, 212 Grafton-ave., Dayton, O., cement blocks, cement sidewalks, cement foundations, cement tile.

Artilithic Company, Holmesburg, Philadelphia, Pa., appliances, mixers, etc., for concrete work in general.

A. C. Henson, supt. W. C. Mfg. Co., Wauchula, Fla., one hollow building block machine and one mixer.

C. M. Preston, genl. mgr. Bibb Stone & Tiling Company, Macon, Ga., cement mixer.

O. J. Raymond, Webb City, Mo., concrete mixer.

C. S. Beadle, Sault Ste. Marie, Mich., cement block machinery.

Von Bochon Building & Real Estate Company, Kalamazoo, Mich., cement blocks and concrete work.

Walter McGovern, 522 Smith-st., Peekskill, N. Y., concrete blocks and general use.

J. M. Williamson, Clearwater, Fla., block machines, sewer moulds, sidewalk tools, concrete mixers, etc.

F. M. Monger, Markleville, Ind., concrete mixer.

John McKinney Son Company, Piper City, Ill., cement block and cement sand and brick machines.

O. H. Monger, cy. engr., Greenfield, Ind., engineering instruments.

H. A. Mark, University Place, Neb., gravel crusher and concrete machine for artificial stone plant.

Sweet & Elmore, Martinsville, Ind., concrete building blocks.

Indianapolis Mortar & Fuel Company, 23 E. Market-st., Indianapolis, cement blocks and cement products in general.

Mayo Brick and Tile Company, Walhalla, N. D., machinery for burning and grinding natural cement.

S. Pearson, 3197 Hamilton-st., Bellaire, O., machinery for cement works of all kinds.

Ole Prone, Ladysmith, Wis., machinery for manufacturing cement, stone and building blocks.

F. E. Butler, Jamaica, Ia., Machinery for cement block and post business.

J. L. Williams,, secretary Bevier Hollow Cement Building Block Company, Bevier, Mo., molds for ornamental cement work, sills, water tables, caps, etc.

C. W. Wade & Son, 714 Chestnut-st., Mishawaka, Ind., cement block machinery.

James Lattrell, Houghton, Mich., water and sewer tools.

A. E. Holmes, care City Engineer,, Des Moines, Ia., trench machines, drainage, pile drivers, steel piling, conveyors, sewer tools.

Joseph H. Steele, 127 Russell-ave., Sisterville, W. Va., machinery for manufacturing concrete blocks.

John J. Spangler, Jefferson, Wis., machinery and tools for mason contractor.

D. J. McAdams, 135 La Moyne-ave., Washington, Pa., conveyors and washing machinery for coal.

Tony Wirig, Fort Atkinson, Wis., cement building block machines, etc.

H. W. Beall, Sumter, S. C., advises us that he is starting in the manufacture of cement blocks and other products, and desires to correspond with makers of machines and tools.

Edw. Cunningham, C. E., Philadelphia, Pa., advises us that about Jan. 1, 1905, the Artilithic Company will open its yard at Olney, Philadelphia, for manufacturing artificial stone for all purposes and concrete work generally. No special system will be adhered to in block work, but all demands will be met. Information is desired regarding appliances, mixers, etc. Temporary address, Holmesburg, Philadelphia.

D. G. Zeigler, Sumter, S. C., advises us that he desires prices on a complete up to date brick and drain tile plant, and on concrete block machinery. Mr. Zeigler will endeavor to get his plant up and ready for operation by February, 1905.

Sam G. Shaffer, Ness City, Kas., advises us that he desires information on artificial stone posts, etc., made from cement and sand.

H. A. Mark, University Place, Lincoln, Neb., advises us that he has been appointed information committee in the formation of a company for the manufacture of artificial stone, to operate in Eastern Wyoming.

S. N. Peters, Greensboro, N. C., advises us that he contemplates organizing a company for the manufacture of concrete hollow blocks and cement sewer pipe, and desires to correspond with manufacturers of machinery for making concrete hollow blocks and cement sewer pipe.

L. R. Marson, mgr. Artificial Stone & Const. Co., Ardmore, I. T., advises us that a number of towns in Indian Territory will want machines and tools soon for manufacturing concrete blocks.

J. M. Ackerman, Albuquerque, N. M., vises us that he is interested as a possible purchaser in a concrete mixer and all concrete tools, cement brick machines, sills and sand brick machines.

Leigh Pruden, 306 Boston Block, Seattle, Wash., advises us that he desires to pruchase reinforced concrete methods, dies for cement ornaments, block molds, cément users' tools, mixers and rock crushers.

J. Franklin Levering, 235 W. Seventh-st., Chester, Pa., advises us that he is interested as a possible purchaser of brick machinery for dry process and mixers.

PURCHASE OF MATERIALS.

We have been advised during December by the following people that they are interested as possible purchasers of materials in the following:

L. R. Marsten, mgr. Artificial Stone and Construction Company, Ardmore, I. T., cement.

Tony Wirig, Fort Atkinson, Wis., cement.

Wm. W. Lyon, Lock Box 340, Tallahassee, Fla., brick, cement, vitrified pipe, etc.

John J. Spangler, Jefferson, Wis., cement, brick, cut stone.

Clark Cement Company, Pendleton, Ind., cement.

A. E. Holmes, care cy. engr. Des Moines, Ia., reinforced concrete, sewer pipe, expanded metal, brick.

Jas. Lattrell, Houghton, Mich., materials for railroad work.

J. L. Williams, sec'y. Bevier Hollow Cement Building Block Company, Bevier, Mo., coloring for cement blocks and water-proofing formula.

C. W. Wade & Co., 714 Chestnut-st., Mishawaka, Ind., cement.

J. M. Ranger, Pelican Rapids, Minn., cement.

Indianapolis Mortar and Fuel Company, 23 E. Market-st., Indianapolis, Ind., cement.

Sweet & Elmore, Martinsville, Ind., cement, lime, etc.

H. A. Mark, University Place, Neb., Portland cement, etc.

F. M. Monger, Markleville, Ind., cement.

Von Bochen Bldg. and Real Estate Co., Kalamazoo, Mich., cement.

Walter McGovern, 522 Smith-st., Peekskill, N. Y., cement.

Gem City Concrete Block Company, 212 Grafton-ave., Dayton, O., cement, sand and gravel.

George Seavey, Cedar Falls, Ia., Portland cement.

O. A. Dever, Cassopolis, Mich., cement.

C. A. Owens, Owen, O., stone, lime and blocks.

W. H. Boyd, Jamaica, Ia., cement and coloring material for cement.

A. C. Henson, supt. W. C. Manufacturing Company, Wauchula, Fla., formulas for mixture to make blocks dry out quick, lime, coloring minerals and first-class cement.

W. J. Littlejohn, Seneca Falls, N. Y., crushed stone.

Peter Helfrich, Spencerport, N. Y., Portland cement.

Joseph F. Oilbacher, Elizabeth, N. J., lime, plaster, crushed limestone, sand, brick, etc.

D. M. Click, South Omaha, Neb., Portland cement.

Boys' Industrial Home, 617 E. Third-st., Williamsport, Pa., cement.

Ole Prone, Ladysmith, Wis., cement.

Sealed bids are asked until Jan. 16, 1905, by the Isthmian Canal Commission, Washington, D. C., for dynamite and explosives, including nitro-glycerine, dynamite, blasting powder, platinum fuses, caps and fuses. J. G. Walker, chmn. Isthmian Canal Comn.

LIGHTING AND POWER.

W. B. Lee, Westbrook, Minn., has organized the Leo Gaslight Co., at Mankato, Minn., to manufacture gas lamps for streets and buildings.

George Weetman, Bemidji, Minn., has applied for a patent on an improved acetylene gas plant.

New gas and electric light and power companies have been incorporated as follows:

Cuyahoga Light and Power Co., Cleveland, O.—C. L. Denton, H. J. Caldwell, Abraham Lowenthal, E. Umbstatter and M. V. Little.

El Paso Gas and Electric Co., El Paso, Tex.—William Barrett Ridgley, Washington, D. C.; George F. Goodnow, Waukegan, Ill.; Fletcher S. Heath, Frank R Crane, Edward Clifford, Chicago, Ill.; George D. Flory, Charles Bassett, El Paso.

Yankton Improvement Co.—Isaac Piles, Wm. S. Stockwell, Sanford G. Donaldson and Michael Magner.

Patterson Street Lighting Co., St. Paul, Minn.—Chas. Patterson, Wm. O'Donnell, and Thos. McDermott.

Etowah Light and Power Co., Attalla, Ala.—A. L. Dupre, Attalla; J. R. Brown, Attalla; Adolphus Brown, Ragland.

Colonial Beach Electric and Power Company, Colonial Beach, Va.—Warren S. P. Combs. F. F. Ninde, W. Frank Renshaw of Colonial Beach.

Oconee River Water, Light and Power Company, Walhalla, S. C.—James Thompson, William J. Stribling, Walhalla; W. B. Frink, New York City.

Dunkirk Lighting Company, Dunkirk, Ind.—Charles A. Harkins, Charles O. Reynolds, Jesse M. Soper.

Queens—Nassau Light and Power Company, Valley Stream, N. Y.—G. F. Swinnerton, New York City; A. Feshay, R. K. Thompson, Brooklyn.

Humble Electric Company, Humble, Tex.—J. C. Wilson, F. A Peters, F. D. Lyon, Houston.

Mackinaw Electric Light Company, Mackinaw, Ill.—S. A. Thompson, George Tyrell, C. G. Sparks.

Harrisville Electric Light Company, Harrisville, N. Y.—Thomas J. Wilber, Joseph Weeks, sr. Dr. D. J. Culver and others.

Parr Shoals Power Company, Newberry, S. C.—W. G. Houseal, C. H. Cannon, W. K. Sligh and Z. F. Wright of Newberry and A. L. Scott of Greenville.

Siloam Springs Railroad Power and Light Company, Siloam Springs, Ark.—D. Zimmerman, Connelly Harrington, R. J. Alfrey, E. C. McCulloch and others.

Michigan Light Company, Jersey City, N. J.—Walter B. Mahoney, Walter Thiele, Charles N. King, all of Jersey City.

Phelps Light Company, Buffalo, N. Y.—William Hooker, Batavia; E. W. Phelps, W. E. Hooker, Buffalo.

Ada Electric Company, Belleville, Ill.—J. A. Hamilton, A. B. Daab, L. D. Turner, jr.

Gas and Fuel Manufacturing Company of America, Washington, D. C.—William Brown, Edward W. Anderson, Samuel E. Lewis.

J. M. Ackerman, Albuquerque, N. M., cement.

J. Franklin Levering, 235 W. Seventh-st., Chester, Pa., sand cement.

MISCELLANEOUS.

The Electrox Water Company, Louisville, Ky., has been incorporated to purify water by Moses Pulverman, Harry Brownell and Chas. Palmer.

The Nashville Bridge Company, Nashville, Tenn., has been incorporated by Art J. Dyer, H. B. Rowan, H. W. Buttorff, E. T. Lewis and J. H. Howe.

The Ferrolithic Water, Sewage & Construction Company, Washington, D. C., has been incorporated by Raymond B. Dickey, Daniel J. Wilson and Howard C. Riley.

Manager Barnett of the Sandstone Company of Sandstone, Minn., contemplates installing a plant for the manufacture of creosoted paving blocks.

The merchants of Centerville, Ia., gave a banquet recently to celebrate the completion of the first paving in that city, and in honor of the McCarthy Improvement Company and J. E. Hogan, who superintended the work of construction. "Greater Centerville" was the theme at the banquet, and 130 business men, property owners and citizens of the city were seated at the tables. A tabulated statement of the public improvements in Centerville during the last year shows the total amount expended, including the paving, is $367,000

Patents Concerning Cement and its Uses.

The following is the third installment of a list of patents on the manufacture and use of cement and machinery for the same issued since June, 1903:

732,881. July 7, 1903. Collapsible Centering. B. H. Muehle, Detroit, Mich.

747,386. Dec. 22, 1903. Mold for Building Blocks. E. W. Dietz and H. W. Spalding, Akron, O.

747,496. Mold for Concrete Blocks. H. H. Spears, Louisville, Ky.

747,653. Mixer for Plastic Material. G. A. Schillinger, Chicago, Ill.

747,882. Manufacture of Cement. Carl Von Forell, Hamburg, Germany.

747,919, 747,920, 747,921. Cement and Process of Making same. Hermann Passow, Hamburg, Germany.

748,049. Dec. 29, 1903. Machine for Molding Building Blocks. James B. Cottom, Dayton, O.

748,140. Machine for Making Cement Shingles. G. C. Zwerk, Saginaw, Mich.

748,141. Cement Shingle. G. C. Zwerk, Saginaw, Mich.

748,352. Concrete Building Wall. A. I. Dexter, Birmingham, Ala.

748,595. Jan. 5, 1904. Method of Waterproofing and Finishing the Surface of Stone, Brick or Other Analogous Porous Material. Neal Farnham, Chicago, Ill.

748,606. Railway Tie. Jacob Horr, Mechanicsburg, O.

748,611. Art of Making Cementitious Products or Artificial Stone. W. E. Jaques, Grand Rapids, Mich.

748,666. Artificial Stone Molding Machine. James Sinclair, Chicago, Ill.

748,817. Fence Post. G. W. Todd, Platteville, Wis.

748,943. Process of Manufacturing Hydraulic Cement. Julius Gresly, Liesberg, Switzerland.

748,946. Fence Post. Henry Hansberger, Millersport, O.

749,020. Building Block. Orville H. Bolen, Denver, Colo.

749,554. Jan. 12, 1904. Fence Post and Electrical Conductor. C. E Griffin, Sac City, and H. A. Low, Lake City, Ia.

749,771. Jan. 19, 1904. Bridge. E. H. Arnold, Wheaton, Ill.

749,796. Building Block and Wall. F. E. Kidder, Denver, Colo.

749,812. Fireproof Building Construction. C. F. Buente, Pittsburg, Pa.

750,066. Fireproof Floor Construction. Joseph Schall, Evergreen Park, Ill.

750,256. Jan. 26, 1904. Fence Post. S. O. Campbell, East Peru, Ia.

750,456. Composite Building Material. Rudolph Hartman, Madison, Wis.

750,641. Vibrator for Molding Apparatus. F. W. Hall, Camden, N. J.

750,837. Feb. 2, 1904. Mortar Holding and Discharging Device. F. C. Ferris, Columbus, O.

750,949. Apparatus for Use in the Manufacture of Artificial Stone, etc. W. A. Darrow and A. C. Wood, Philadelphia, Pa., and J. R. Allen, Merchantville, N. J.

751,089. Method of Making Concrete Building Blocks. F. A. Malette, Geneva, N. Y.

751,133, 751,134. Apparatus and Process for Preparing Pulverulent Materials for Molding or Biqueting. E. B. A. Zwoyer and R. A. Zwoyer, Hokoben, N. J.

751,181. Centering Support. G. H. Kunneke, New York.

751,346. Building Tile. Joseph Schall, Evergreen Park, Ill.

751,427. Reinforcement for Concrete Beams. A. J. Bossyns, Mt. Washington, Md.

751,541. Feb. 9, 1904. Rotary Feeding Device for Concrete Mixers. S. P. McKelvey, Chicago, Ill.

751,622. Fence Post. J. R. Engstrom, Manchester, Ia.

751,711. Building Block. E. O. Baylor, Adrian, Mich.

751,789. Method of Building Concrete Walls, etc. D. G. Gray, Philadelphia, Pa.

751,898. Mortar Mixer. A. Bodlaender, Breslau, Germany.

751,904. Hydraulic Press for Molding Artificial Stone and the Like. W. H. Fisher, Oklahoma, Okla.

752,003. Process of Forming Concrete Piles. Frank Shuman, Philadelphia, Pa.

752,249. Feb. 16, 1904. Form for Making Holes or Conduits in Concrete or Other Structures. Ernest Nickerson, Newton, Mass.

752,298. Press for Molding Building Blocks. J. H. Perrin, Columbus, O.

752,354. Composition Post. Wesley W. Northrup, Belleville, Mich.

752,523. Armed or Stiffened Concrete Construction. A. G. Considere, Paris, France.

752,753. Feb. 23, 1904. Railway Tie. A. M. Bowman, Bellevue, Pa.

752,841. Storage Bin. J. A. Jamieson, Montreal, Can.

753,008. Forming Concrete Piles. Frank Shuman, Philadelphia, Pa.

753,188. Cement Roofing Plate. Henry Baden and William Gluss.

753,249. March 1, 1904. Apparatus for the Manufacture of Concrete Bricks, Etc. L. J. Dumm, Columbus, O.

753,286. Building Block. J. D. Morrison, Reinbeck, Ia.

753,303. Mold for Cement Blocks. W. G. Park, Avon, Ill.

753,347. Fence Post. Andrew Adam, Kendallville, Ind.

753,377. Machine for Molding Building Blocks or Stones. W. L. Dow, Sioux Falls, S. D.

753,385. Process of Maturing Portland or Other Hydraulic Cements. H. A. Gerdes, Minneapolis, Minn.

753,491. Building Block A. F. Hoffman, Pittsburg, Pa.

753,603. Steel Concrete Construction, Etc. J. S. Metcalf, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Canandaigua, N. Y.—The Lisk Manufacturing Company contemplates experimenting with cinders spread to a depth of six inches, sprinkled with crude petroleum, and thoroughly rolled with a steam roller, as a paving material, on one of the streets of this city.

CONTEMPLATED WORK.

Council Bluffs, Ia.—The question of paving W. Broadway is being considered.

Pocahontas, Va.—Council has decided to issue $40,000 street improvement bonds.

Binghamton, N. Y.—Bitulithic paving has been proposed for the streets of this city.

Collinwood, O.—A petition is being circulated asking that Collins-ave. be paved with brick.

Chicago, Ill.—Asphalt, macadam and granite paving is contemplated for a number of streets.

Bellingham, Wash.—The property owners on Elk-st. will petition for vitrified brick paving.

Racine, Wis.—Plans and specifications have been prepared for paving Douglas-ave. with brick.

Missoula, Mont.—Council has directed that all sidewalks hereafter constructed shall be of cement.

Louisville, Ky.—Ordinances have been adopted for paving Fifth-st., from Hill to Bloom, with asphalt.

Salisbury, Md.—City Council contemplates the construction of street improvements at a cost of $20,000.

Swanville, Minn.—Cement sidewalks will probably be constructed on the principal streets next season.

Newark, N. J.—Bids will be asked in the spring for paving Weeds-ave. and Stanbury-st. C. H. Wells, city engineer.

Mankato, Minn.—The property owners on Front-st., from Poplar to Washington, have petitioned for brick paving.

Boone, Ia.—Council has adopted plans for about 2,000 square feet of brick sidewalks and bids will be asked soon.

Painesville, O.—Specifications have been prepared, according to press reports, for 1,850 square yards of brick paving.

St. Augustine, Fla.—The City Council is considering the question of paving King and Malaga-sts. with vitrified brick.

Seattle, Wash.—A resolution has been passed providing for the paving of Third-ave., from Pike to Union-sts. with asphalt.

Findlay, O.—A petition is being circulated asking that Tiffin-ave. be paved with vitrified brick. John W. S. Riegle, city engineer.

Oakmont, Pa.—A resolution has been passed favoring the issue of $150,000 bonds for paving the principal streets of this borough.

San Antonio, Tex.—The citizens have voted, according to press reports, to issue $15,000 bonds for paving Commerce-st. with asphalt.

Des Moines, Ia.—A petition is being circulated among the property owners asking that Kingman-boulevard be paved with asphalt next spring.

Syracuse, N. Y.—The construction of four miles of brick and asphalt paving is contemplated during the next year, according to press reports.

Kalamazoo, Mich.—City Engineer Taft has been directed to prepare estimates for paving W. Main-st., west of the Michigan Central crossing, with brick.

Canton, O.—Vitrified block paving is contemplated during the next year for portions of E. Fourth, E. Third and Mahoning-sts. Charles H. Zellars, clerk B. P. S.

Baltimore, Md.—Ordinances have been passed providing for an appropriation of $10,000 for paving Park-ave. with asphalt blocks; also Patuxent-st. with asphalt.

Oshkosh, Wis.—Brick paving is contemplated for Division and S. Main-sts., tar macadam for Franklin-ave. and Telford macadam for a number of other streets next spring.

Grand Rapids, Mich.—Estimates have been prepared for paving as follows: Lake-ave., from S. Union to S. East-st., macadam, $7,750; brick, $12,590; brick, $13,750.

Wildwood-by-the-Sea, N. J.—The property owners on all streets between the West Jersey & Seashore Railroad and Park-ave. have petitioned for the construction of cement sidewalks.

Syracuse, N. Y.—Resolutions have been introduced providing for the paving of Park-ave., from Geddes to Liberty-sts., and University-ave., from E. Genesee to E. Fayette-sts., with brick or asphalt.

Baraboo, Wis.—An ordinance has been adopted directing the city engineer to prepare plans for macadamizing Second-ave., from Ash to Park-sts., with gutters, and from Park-st. to the city limits without gutters. Mayor Marriott.

Jeffersonville, Ind.—Plans are being prepared by Victor M. Lyon, city engineer, for reconstructing Market-st., one and a half miles, with granitoid

sidewalks, stone curbing and vitrified brick gutter, and four blocks of Walnut-st. with granitoid sidewalks.

Knoxville, Tenn.—The Chamber of Commerce has taken up the question of improving the streets of this city, and has invited the citizens to meet with it the second Tuesday in January, 1905, to discuss street paving and other needed improvements.

Denver, Colo.—The Board of Public Works is considering the matter of providing for the grading, paving and curbing of streets in the Eleventh Ward, building Cherry creek driveway and other improvements to begin next spring, aggregating a total cost of $460,000.

Omaha, Neb.—The city engineer has been directed to prepare plans for paving S. First, Harmony, Benton, Eighth and Ninth-sts., Fletcher, Fourth and Eighth-aves. and an alley with vitrified brick on concrete base. An ordinance has been passed creating a district in which all brick and plank sidewalks needing repairing in the future must be replaced with cement.

San Francisco, Cal.—In his annual report City Engineer Woodward recommends the use of paving brick in the construction of gutters in connection with smooth pavements, and that specifications for asphalt pavement be changed to allow the use of California oil asphalts, which make a pavement better suited to heavy traffic than bituminous rock pavements.

Tacoma, Wash.—The property owners on New Jersey-st., from Division-ave. to Steele-st., have petitioned for asphalt paving. The question of paving Sixth-ave., from St. Helens-ave. to Pine-st., with block or asphalt is being discussed. The streets and alleys committee will probably recommend the formation of three new street improvement districts, involving an expenditure of about $400,000.

CONTRACTS TO BE LET.

Louisville, Ky.—Bids are asked until Jan. 3 for vitrified brick paving. B. P. W.

Norwood, O.—Bids are asked until Jan. 7 for macadamizing Lloyd-ave. E. R. Edwards, clerk B. P. S.

Glenville, O.—Bids are asked until Jan. 11 for grading and paving St. Clair-st. M. W. Miles, secretary B. P. S.

Rensselaer, Ind.—Sealed bids are asked until Feb. 7 for constructing gravel roads. James N. Leatherman, county auditor.

Lebanon, Ind.—Sealed bids are asked until Jan. 7 for constructing the Antioch gravel road. Jacob O. Parr, superintendent construction.

Waterbury, Conn.—Sealed bids are asked until Jan. 3 for constructing a section of macadam road. R. A. Cairns, city engineer.

Omaha, Neb.—Sealed bids are asked until Jan. 13 for a municipal asphalt repair plant. Andrew Rosewater, chairman B. P. W.

Olathe, Kas.—Bids are asked until Jan. 6 for paving and curbing Water, Cedar and Chestnut-sts. C. F. Garwood, city clerk.

Columbus, Ind.—Sealed bids are asked until Jan. 6 for constructing one mile of macadamized road in Rock creek township. John Grant, chairman county commissioners.

Atlantic City, N. J.—Sealed bids are asked until Jan. 16 for paving Atlantic-ave. with asphalt and bitulithic, with granite or concrete curbing. City Engineer Hackney.

Webb City, Mo.—Bids are asked until Feb. 7 (readvertisement) for paving Allen, Daugherty, Main, Webb and Church-sts. with vitrified brick. W. E. Smith, city engineer; Mayor Moore.

Knox, Ind.—Bids are asked until Jan. 16 for macadamizing and paving with gravel roads in Wayne, Jackson, California and Center townships, aggregating about 16,100 feet. John W. Kuntz, county auditor.

Toledo, O.—Bids are asked until Jan. 3 for paving Norwood-ave. and repaving Prescott and Huron-sts. with block, sheet asphalt, bitulithic or other bituminous macadam. Harry S. Jones, secretary B. P. S.

CONTRACTS AWARDED.

Helena, Mont.—The Barber Asphalt Paving Company was awarded the contract for paving Main-st. with asphalt for $57,506.

Cincinnati, O.—The contract for paving Strader-ave. and Buchanan and Hill-sts. with brick was awarded to William Fogarty, Dec. 13.

Burlington, Ia.—The contract for paving Sixth-st., from Market to Division, with brick, was awarded to the Burlington Construction Company.

St. Louis, Mo.—Bids were received Dec. 9 for paving portions of a large number of streets, but contracts have not yet been awarded.

Watertown, N Y.—The contract for paving State and Washington-sts. with bitulithic was awarded Dec. 6 to Warren Brothers Company of Boston, Mass.

Terre Haute, Ind.—Contracts for constructing about sixteen miles of roads in Otter Creek and Nevins townships was awarded to W. H. Harris for about $27,000.

Tacoma, Wash.—George Milton Savage & Co. secured the contract, Dec. 10, for paving in improvement district No. 239, from N. Twenty-fourth to N. Twenty-seventh, and Union-ave. to Cedar-st., for $18,433.40.

Celina, O.—Special—J. E. Conley & Co., Dayton, O., has the contract for 31,000 square yards of brick paving (Metropolitan block), and necessary surface sewers, on Main-st., in this city. The contract amounts to about $75,000.

Mobile, Ala.—The contract for paving St. Louis and Claiborne-sts. with creosoted wooden blocks was awarded, Dec. 17, to the Republic Creosoting and Chem-

ical Company, Indianapolis, Ind. The company will establish a $40,000 creosoting plant in this city.

St. Paul, Minn.—The contract for asphalt paving on Franklin-st., from Third to Ninth, was awarded, Dec. 12, to the Barber Asphalt Paving Company, for $11,512. The contract for macadamizing Rice-st., at the Soo crossing, was awarded to Joseph P. Lange for $1,400.

Vailsburgh, N. J.—Special—Eugene MacMurray, city engineer, says bids were received Dec. 7 for grading, curbing and walks in a large number of streets as follows: Frank W. Snider, $15,268; Jacob Clark Stone Company, $6,661.75; Essex County Stone Construction Company, $14,247.66.

Los Angeles, Cal.—Frank Gillespie was awarded the contract for grading and graveling Stephenson-ave., from Boyle-ave. to east boundary line, as follows: Grading and graveling, $2.45 a line foot; curb, 31 cents a lineal foot; gutter, 7 cents a square foot; culverts, $2,000, complete.

Birmingham, Ala.—Special—In accordance with the petition of the taxpayers on Highland-ave., one of the leading residence streets, a contract was awarded to the Nashville Roofing and Paving Company, Dec. 8, for about 50,000 square yards of bitulithic paving. The work of construction will begin at once. During 1903 and 1904 this company has constructed about 322,546 square yards of bitulithic pavement in this city.

Birmingham, Ala.—The Nashville Roofing and Paving Company was awarded the contract for paving Fifth-ave. with bitulithic pavement, Dec. 21. Other contracts awarded were as follows: Paving sidewalks with artificial stone, Crockett Paving Company, 86 cents a square yard; 6-inch granite curbing, 44½ cents a lineal foot; grading and macadamizing, Allison, excavating, 24 cents a cubic yard; slag, 72 cents a cubic yard; chert, $1.05 a cubic yard; straight curb, 43 cents a lineal foot; curbed curb, 48 cents a lineal foot; solid rock excavating, 75 cents a cubic yard; exctvating under pipe, 60 cents a cubic yard.

New York City—Bids were opened Dec. 14 for regulating, grading, curbing and flagging Delancey-st., from Clinton-st. to the Bowery, as follows: Bart Dunn, $14,298; John E. Quinn, $15,480; Thomas A. Brown, $14,400; M. Fitzerald, $18,270; Cunningham & Kearns, $14,130; James Murray, $18,600. Bids were also opened Dec. 14 for regulating and repaving with asphalt block on concrete foundation, Broadway-st., from 119th-st to Manhattan-st., 16,230 square yards, as follows: Asphalt Construction Company, $1.40 a square yard for paving, and total, $40,166; New York & Bermudez Company, $1.59, or $38,042; Harlem Construction Company, $1.90, or $47,408.

Philadelphia, Pa.—Bids were opened Dec. 15 for paving work as follows:

Repairs to paved streets for entire city in 1905: M. O'Rourke, $127,000; Mack Paving Company, $142,000, and M. & J. B. McHugh, $153,000.

Maintenance of improved and macadamized highways of the entire city: D. McMahon, $128,000; E. H. Vare, $120,000, and W. H. H. Achuff, $135,000.

Resurfacing roads with stone, price per square yard (a) rolled, (b) unrolled: E. H. Vare, a 70 cents, b 40 cents; J. J. Connor, a 67 cents, b 59 cents; J. P. Shanley, a 82 cents, b 72 cents; W. H. H. Achuff, b 80 cents; D. McMahon, a 78 cents, b 68 cents.

Repairs to asphalt streets (price per square yard), Barber Asphalt Company (3 bids), $2.11, $1.58 and $1.49; and Filbert Paving Company (3 bids), $2.14, $1.49 and $1.39.

SEWERS.

CONTEMPLATED WORK.

Fremont, O.—A new sewer in the Third Ward is proposed.

Ocean Park, Cal.—A sewerage system is contemplated.

Escanaba, Mich.—Plans will be prepared for a sewer system.

Glenolden, Pa.—The extension of the sewerage system is proposed.

Kirkwood, Mo.—Plans have been prepared for constructing a sewerage system.

Traer, Ia.—The citizens are demanding the construction of a sewerage system.

Woodlawn, Ala.—Bonds will be issued for constructing a sanitary sewerage system.

Redondo, Cal.—The estimated cost of constructing a sewerage system is $40,000.

Oshkosh, Wis.—Sewers are contemplated in Knapp, Main, Murdock and Vinland-sts.

St. Joseph, Mo.—Bids for constructing a main sewer will be let during January or February.

Washington, Ia.—Plans for constructing sewers will be made by Engineer Kimball of Davenport.

Marion, S. C.—This town voted to issue $25,000, Dec. 15, for building a sewerage system.

North Yakima, Wash.—This city will vote in January on the issue of bonds for building a sewerage system.

Baltimore, Md.—Frank A. Furst is chairman of the improvement committee in charge of the proposed sewerage system.

Gettysburg, Pa.—Plans and specifications for a sewerage system are being made by Mason D. Pratt of Harrisburg.

Red Oak, Ia.—The property owners have petitioned for the construction of a sewer on Nuckle-st., from First to Fifth.

Chicago Heights, Ill.—Plans for a sewerage system for this city have been prepared by Alvord & Burdick of Chicago.

St. Clair Heights, Mich.—The question of issuing $20,000 bonds for building a sewerage system is under consideration.

North Tonawanda, N. Y.—The question of issuing $60,000 bonds for the extension of the sewerage system will be voted on.

Jersey City, N. J.—Plans for the Division-st. relief sewer are being prepared by C. H. Van Keuren, chairman engineer Street and Water Works Commissioners.

Conneaut, O.—The question of forming a new sewer district and building a sewer direct to the lake is under consideration.

Morgantown, N. C.—The question of issuing $25,000 bonds for constructing the proposed sewer system will be voted on next May.

East St. Louis, Ill.—Bids will be asked next spring for constructing several miles of new sewers. W. J. Croeken, city engineer.

New London, Wis.—The estimated cost of the proposed new sewerage system, covering sixteen miles of lateral and main sewers, is $100,000.

Sacramento, Cal.—An ordinance has been signed by the Mayor providing for the issue of $165,000 bonds for sewers and levees.

Denver, Colo.—Resolutions authorizing the construction of storm sewers for Capitol Hill have been completed and bids will be asked.

Bristol, Pa.—A petition will be submitted to the Legislature asking for permission to issue bonds for the establish-proposed new sewerage system.

Springfield, O.—Charles C. Bauer, city auditor, has been directed to take the preliminary steps for constructing the proposed new sewerage system.

Allegheny, Pa.—Council has passed an ordinance authorizing the expenditure of $25,000 for constructing public sewers on Peebles-st. and Evergreen-road.

Girard, O.—The citizens' committee recommends that the citizens ask Council to call an election for the purpose of issuing bonds to build a sewerage system.

Hamtramck, Mich.—This town will vote again Jan. 3 on the question of issuing $68,000 bonds for constructing a sewer to connect with the Detroit system.

Rockville, Conn.—At the annual meeting Dec. 6 this city appropriated $75,000 for the construction of a septic tank system and filtration beds for the disposal of their sewage.

Philadelphia, Pa.—The Bureau of Surveys has asked for $300,000 for the construction of branch sewers, inlets and manholes; $500,000 for main sewers; $50,000 for improving Cohocksink sewers.

CONTRACTS TO BE LET.

Ivanhoe, Minn.—Bids are asked until Jan. 6 for constructing ditch No. 2. R. H. Sisson, county auditor.

Lebanon, Ind.—Sealed bids are asked until Jan. 9 for constructing a storm sewer in the Third Ward. Edmund Connor, city clerk.

Willmar, Minn.—Bids are asked until Jan. 10 for constructing ditch No. 19. L. Johnson, county auditor.

Marion, Ind.—Sealed bids are asked until Jan. 3 for building sewers. John O. Willson, city clerk.

Litchfield, Minn.—Bids are asked until Feb. 25 for constructing ditch No. 21. J. N. Gayner, county auditor.

Springfield, Mo.—Bids are asked until Jan. 3 for constructing certain sewers. W. N. Schreiber, city engineer.

Amarille, Tex.—Bids are asked until Jan. 16 for constructing a sanitary sewerage system. S. Lightburne, Mayor.

Mamaroneck, N. Y.—Sealed bids are asked until Jan. 4 for constructing two miles of sewers. Lyriel Warren, president Board Trustees.

Cincinnati, O.—Sealed bids are asked until Jan. 5 for building sewers and drains on Mistletoe-st. and Kineon-ave. George F. Holmes, clerk B. P. S.

Cresco, Ia.—Bids are asked until Feb. 1 for constructing 6,270 feet of eight-inch vitrified pipe sewer, 14 manholes and 3 sewer flush tanks. W. L. Richards, chairman Sewerage Committee.

Jefferson City, Mo.—The bids received Dec. 15 for constructing a sewer in district No. 11 were rejected and new bids asked for, to be received at 4 p. m., Jan. 4. J. C. Herring, city engineer.

New Orleans, La.—Sealed bids are asked until Jan. 31 for constructing 65 miles of sewers and appurtenances, and furnishing 15 miles of c. i. water mains and appurtenances, and 4,000 feet of railroad track. George G. Earl, General Superintendent.

Bishop, Cal.—Bids are asked until Jan. 10 for constructing a sewerage system, consisting of 9,700 feet of 6 to 14-inch vitrified pipe; 9,710 feet of trenching; 4 Miller-Potter flush tanks; 8 manholes; 250 Y connections; 8,400 feet 4 to 8-inch drain tile. Board Trustees.

CONTRACTS AWARDED.

Burlington, Ia.—W. A. Edgar of Cedar Rapids was awarded the contract for 3,200 feet of sewers.

Hamilton, O.—Contracts for constructing sewers on S. D and S. Thirteenth-sts. were awarded to W. H. Louthen.

Springfield, Mo.—The contract for constructing vitrified pipe sewers was awarded to J. F. Kieser for $7,600.

Dayton, O.—The contract for building a sewer on River-st. and Ferguson-ave. was awarded to J. J. Smith for $1,113.

St. Paul, Minn.—Christ Johnson secured the contract for building a sewer on Beacon and St. Anthony-aves. for $1,757.

Denver, Colo.—The contract for constructing the West Colfax sanitary sewer was awarded to Gaffy & Keith at $38,000 to $40,000.

Bessemer, Ala.—The contract for constructing the sewer of this city to the

Jefferson County trunk sewer at Valley Creek has been let to Black & Laird.

Jackson, Mich.—The contract for building a 5-foot sewer on Wildwood-ave. and a 3-foot sewer on Wildwood-ave and Wisner-st. has been awarded to P. Casey & Co.

Muskogee, I. T.—The contract for constructing a sewerage system was awarded to the Phelps & Nesbit Construction Co. of Dexter, Ia., for $12,250, and the contract for septic tanks to the N. O. Nelson Co., St. Louis for $3,500.

Pine Bluff, Ark.—Bids were submitted Dec. 13 for constructing 24,000 feet of pipe sewers, as follows: I. P. Shelby, Pine Bluff, $17,014; Robinson Bros., Pine Bluff, $15,647; W. W. Cook & Son, Junction City, Kas., $18,427; H. C. Gass, Belleville, Ill., $14,395; E. G. Trueheart, San Antonio, Tex., $16,701.

WATER-WORKS.

Springfield, Ill.—Edgar Tolman, corporation counsel of Chicago, appeared before the Supreme Court, Dec. 6, in behalf of the City of Chicago, and asked for a writ of mandamus against Ernest S. Hummell, city treasurer, directing him to turn over to the city $600,000 surplus in the water funds of the city to the corporate funds of the city for the general expenses of the city government. He also asked for a writ of mandamus to compel him to take $672,000 from the permanent improvement bond fund and with it pay for public improvements made last year prior to the passage of the ordinance authorizing the issue of $5,000,000 bonds for permanent improvements. The city contends that the general fund has contributed millions of dollars to the water fund and that by pledging its corporate credit it has furnished millions more, thus reducing its own borrowing power and that, therefore, it is equitable that it draw from the water fund a portion of the surplus profits.

CONTEMPLATED WORK.

Crandon, Wis.—Plans have been submitted for a water works system.

Los Angeles, Cal.—This city is in need of a more adequate water supply.

Medina, N. Y.—A resolution has been passed to purchase a new source of supply.

Bangor, Me.—The Citizens' League committee urges a new water supply for this city.

Louisa, Ky.—Special—W. B. Cox advises us that he desires to purchase a 15-h. p. water motor.

Grand Rapids, Mich.—Bids will be asked soon for a new stand-pipe to be erected in Fuller-st.

Springfield, Mo.—The Springfield Water Works Company is preparing to inaugurate a meter system.

Toledo, O.—The Board of Public Service has purchased a site for the new filtration plant. Harry L. Jones, secy. B. P. S.

Pekin, Ill.—The question of building and operating a municipal water works plant is being considered.

Cincinnati, O.—The recommendation of Acting Chief Benzenberg to install water meters will be adopted.

Santa Ana, Cal.—This city voted to issue $100,000 bonds for improving and extending the water works system.

Woonsocket, R. I.—A resolution has been passed appropriating $45,000 for equipment at the pumping station.

Winooski, Vt.—Surveys and estimates for securing a water supply will be made by Frank O. Sinclair, Burlington, Vt.

Pittsburg, Pa.—The contract for a filtration plant will be awarded about Jan. 15. E. M. Bigelow, dir. pub. works.

Tacoma, Wash.—The bids submitted Dec. 12 for constructing two new wells at South Tacoma were rejected and the work will be readvertised.

Cambridge, Mass.—The Cambridge Water Board in its annual report will recommend the new city officials to pass the pipe line order.

Enid, Okla.—Special—C. H. Sexton advises us that a new pumping plant and reservoir and the extension of water mains is contemplated.

Deadwood, S. D.—Special—Frank L. Peck, Taylor-ave., advises us that he desires to purchase air compressors and mining and milling machinery.

La Crosse, Wis.—Council has taken preliminary steps toward installing a filtering plant for the municipal waterworks system at a cost of $100,000.

Oneida, N. Y.—The matter of constructing another and larger reservoir for the storage of water in the gorge above the present source of supply is being considered.

Salt Lake City, Utah—City Council has adopted plans for increasing the water supply, and a special election will be held Jan. 3 to vote on the issue of bonds.

Clarksburg, W. Va.—Special.—Homer Davis, Box 386, advises us that he is interested in the construction of a complete water system for a town of 15,000.

The question of issuing waterworks bonds has been favorably voted on at the following places: Ft. Pierre, S. D.; Alma, Neb.; Cookeville, Tenn.; Fairfax, S. D.

Creston, Ia.—The water company is considering the adoption of a system of purification and sedimentation of the supply. Plans were made by Andrew Rosewater of Omaha.

Danbury, Conn.—A resolution has been passed authorizing the Mayor to take steps toward obtaining a bond issue for construction, repairs and extensions of the water works system.

Cleveland, O.—Special.—Ralph Hecker, C. E., 412 Electric Bldg., vil. engr. for Newburgh Heights, O., advises us that he is interested in work for which c. i. water pipe may be purchased.

Pittsburg, Pa.—Charters for water companies are being applied for by residents of Chartiers Valley for the purpose of furnishing pure water in large quantities to all boroughs and townships in Chartiers Valley.

The construction of water works plants is contemplated at the following places: Dyer, Tenn.; Bunkie, La.; Granada, Miss.; Kimball, S. D.; Brighton, Vt.; Chrisman, Ill.; Gravette, Ark.; Rimouski, Que.; Albia, Ia.

Glenwood Springs, Colo.—Special.—W. H. Trumber advises us that he desires 5½ mis. of wood or tile pipe, 7,500 ft. 8-in., 3,200 ft. 6-in. and 13,500 ft. 4-in. c. i. pipe, hydrants, valves, sluice gates, small reservoir and head works and cement.

The question of issuing bonds for the construction of water works systems will be voted on as follows: Gillett, Wis., Jan. 3; Montrose, Colo., Jan. 10; Glendive, Mont., Jan. 7; Columbia, S. C.; Abbeville, La., Feb. 1; Hammond, La., Jan. 10; Nevada, Mo.; Thorold, Ont.

Springfield, Mass.—The water commission passed favorably on the plans of the special water supply commission for improving the Ludlow supply, which provide for the construction of a filtration plant, the Ax Factory reservoir, building a new main from the reservoir to the filtration beds, etc. It is believed that Mayor Stone will veto the order.

CONTRACTS TO BE LET.

Bloomfield, Ind.—Bids are asked until Jan. 12 for installing water works. Bd. co. comrs.

Independence, Kas.—Bids are asked until Jan. 3 for constructing a water works plant.

Washington, Ga.—Bids are asked until Jan. 5 for the improvement of the water supply. J. R. Dyson, mayor.

Pocatello, Idaho—Bids are asked until March 31 for furnishing 500 water meters. Pocatello Water Company.

Newcastle, Neb.—Bids are asked until Jan. 12 for constructing a water works system. W. R. Talbot, chmn, vil. bd. trustees.

New Orleans, La.—Sealed bids are asked until Jan. 31 for furnishing and laying 15 mis of c. i. water mains and 4,000 ft. of railroad tracks. Geo. G. Earl, supt. sewerage and water bd.

Bishop, Cal.—Bids are asked until Jan 10 for constructing a water works system requiring 15,000 ft. 6-in., 2,280 ft. 4-in. and 16,570 ft. 2-in. pipe, gate valves, crosses, tees, etc. Town trustees.

Washington, D. C.—Sealed bids are asked until Jan. 5 for constructing a masonry dam and two bridges on Salt River, about 70 miles east of Phoenix, Ariz. The dam will contain about 300,000 cu. yds. of masonry. E. A. Hitchcock, secy.

Washington, D. C.—Bids are asked until Jan. 10 for furnishing 39,000 ft. of standard wrought iron pipe; about 1,200 iron pipe coupling; 110 flanged tees, reducing ells, malleable unions, plugs, etc. J. G. Walker, chmn. Isthmian Canal Com.

Muscatine, Ia.—Bids are asked until Jan. 3 for furnishing and erecting and connecting in new pumping station a 300,000-gal. pumping engine, a 5,000,000-gal. pumping engine, a heater, condenser, auxiliary pumping engine, suction and force pipes, return tubular boilers, etc. Wm. Molis, supt. w. w.

Washington, D. C.—Sealed bids are asked until Jan. 9 for constructing an outlet tunnel about 125 sq. ft. cross section and about 500 ft. long, and 2 vertical shafts in solid granite, to serve as a diversion tunnel for the Pathfinder dam, about 50 mis. s. w. of Casper, Wyo. Thos. Ryan, acting secy.

Hastings, Neb.—Bids are asked until Jan. 9 for plans and specifications for a water works system, to include making a survey of grounds and establishing levels, all plans and specifications for pumping plant, stand pipes, hydrants, etc., examination of wells, analyses of water, complete profile of work, and cost of plant. N. J. Steffen, cy. clk.

CONTRACTS AWARDED.

St. Paul, Minn.—The National Meter was awarded the contract for supplying meters during the next year for about $7,500.

Colfax, Wash.—The contract for wood pipe for the water works system was awarded to the Washington Wood Pipe and Foundry Co. of Tacoma at $2,000 per mi., or $28,000.

Chicago, Ill.—The contract for furnishing two 40,000,000-gal. pumps for the Central Park-ave. and Springfield-ave. pumping stations was awarded to Henry A. Worthington for $178,500.

Pueblo, Colo.—The contract for constructing the 211-acre reservoir in the southeast section of the county for the Mustang Land and Cattle Co. was awarded to Remer & Olson. The dam will be 5,000 ft. long.

BRIDGES.

Binghamton, N. Y.—A new bridge across Chenango River will be built in the spring.

Lewiston, Idaho—Bids are asked until Jan. 13 for building a bridge across Desol slough. Co. Comrs.

Oshkosh, Wis. — Bids are asked until Jan. 14 for building the superstructure of the Main-st. bridge.

Knoxville, Tenn.—The citizens are in favor of a concrete viaduct across the railroad tracks on W. Clinch-ave.

Vermilion, S. D.—Bids are asked until Jan. 4 for constructing all county bridges during 1905. L. B. Bridgman, co. audt.

Wayne, Neb.—Bids are asked until Jan. 10 for building and repairing county bridges during 1905. Charles W. Reynolds, co. clk.

Hoosick, Falls, N. Y. — A new iron bridge is desired to replace the old covered one over the Walloomsac River, near Battlefield Park.

Wilkesbarre, Pa. — W. B. Alleger, co.

engr., is preparing plans for thirty new bridges to be built throughout the county and bids will be asked soon.

Topeka, Kas.—Sealed bids are asked until Jan. 9 for building a steel bridge over the Kansas River at Sardou-ave. F. W. Harrison. chmn. bd co. comrs.

South Norwalk, Conn.—Plans and specifications for a new stone arch bridge at Belle Island have been submitted, and the selectmen will advertise for bids soon.

Barberton, O.—Council has passed a resolution requiring the Erie Railroad Company to abolish the Cornell-st. grade crossing and to build a viaduct within six months.

Cleveland, O.—Sealed bids are asked until Jan. 4 for building a steel bridge across Tinkers Creek, Newburgh, and abutments across Big Creek, Brooklyn. Julius C. Dorn, clk.

Macon, Ga.—City Council is considering an ordinance to require railroads that have tracks crossing streets that lead to Central City Park build steel viaducts in those streets.

Springfield, Mass.—Bids are asked until Jan. 11 for removing and rebuilding portions of piers and abutments of bridge over Connecticut River between Chicopee and West Springfield. Robert O. Morris, co. clk.

Centralia, Ill.—Special—This city contemplates constructing a 500-foot concrete subway or steel viaduct for the principal railroad crossing. The Iowa Engineering Company of Clinton, Ia., has been engaged to investigate and report upon the most feasible plan.

STREET LIGHTING.

Chipley, Fla.—An electric light plant is contemplated.

Deadwood, S. D.—A new franchise was granted the Black Hills Electric Light Co. Dec. 13.

Oceanside, Cal.—Bids are asked until Jan. 24 for a gas franchise. H. D. Brodie, cy. clk.

Gillett, Wis.—The question of establishing an electric light plant will be voted on Jan. 3.

Cano City, Colo.—City Council will investigate the proposition of erecting a municipal light plant.

Martinsville, Va.—This town voted, Dec. 15, to issue $60,000 bonds for constructing an electric light plant.

Lincoln, Neb.—The question of issuing bonds for purchasing the electric light plant will be voted on Jan. 3.

Danbury, Ill.—The Business Men's Association is agitating the question of establishing a public lighting plant.

Fullerton, Cal.—Bids are asked until Jan. 10 for the purchase of a gas franchise for this city. G. A. Ruddock, clk.

Burlington, Wis.—The city lighting contract expires soon, and the question of municipal ownership is being considered.

Wyocena, Wis.—The county board has appropriated $2,000 to install an electric light plant in the county buildings here.

Creston, Ia.—A special election will be held Jan. 10 to vote on the franchise asked for by the Electric Light and Gas Co.

Buffalo, N. Y.—Deputy engineer commissioner estimates the cost of a municipal electric light plant for this city at $894,000.

Muncie, Ind.—The contract for lighting Riverside for five years was awarded the Muncie Electric Light Co. at $50 per light per year.

Christiansburg, Va.—Bids are asked until Jan. 5 for a franchise for the operation of an electric light plant. W. C. Flagg, mayor.

Lansdale, Pa.—The question of issuing bonds for the extension and improvement of the electric light plant will be voted on in February.

Greenwood Springs, Colo.—The question o renewing the light and water franchise of the Greenwood Water & Light Company will be voted on Jan. 10.

Irvington, N. J.—A contract was awarded the United Electric Company for furnishing lights for five years at $15 per lamp per year for 30 candle power lights.

Youngstown, O.—A special committee of council has recommended the issue of $100,000 bonds for building a municipal electric light plant.

Little Rock, Ark.—The question of the establishment of an electric light plant by the Retail Grocers' and Merchants' Association has been revived.

St. Paul, Minn.—Bids are asked until Jan. 21 for constructing an addition to the electric light system at Fort Snelling. R. M. Scofield, const. Q. M.

Tarboro, N. C.—Special—John S. Weddell, treasurer water and light department says the extension and enlargement of the electric light plant is proposed.

Terre Haute, Ind.—The contract for electric lights for this city was awarded to the Terre Haute Traction & Light Company for five years at $75 per light per year.

Tamaqua, Pa.—A 10-year contract has been awarded E. M. B. Shepp and John F. McGentry of this city for lighting the streets at $60 per light per year for 2,000 c. p. lamps.

New York City—Mayor McClellan and Comptroller Grout are in favor of a municipal electric light plant. A bill has been authorized providing that this city build and operate a municipal plant.

Lockport, N. Y.—The American District Steam Company has renewed its application for a franchise to use the streets for the transmission of electricity for lighting, heating and power purposes.

Chicago, Ill.—Sealed bids are asked until Feb. 15 for furnishing and installing alternating current generators and generators for exciters. Zina R. Carter, prest. bd. trustees, Sanitary dist.

La Crosse, Wis.—An electric light company is being organized by local parties, according to press reports, which will ask for a franchise for furnishing elec-

tric current for light and power purposes.

St. Paul, Minn.—The Patterson Street Lighting Company was awarded the contract, Dec. 20, for gasoline lighting and for maintenance of gas lights of the city during 1905, at $24.96 per light per year for gasoline lights, and $12.25 per light per year for maintaining gas incandescent lights.

Evansville, Ind. — The Evansville Gas and Electric Light Company was awarded the contract for 285 enclosed arc lights at $67 each and 500 gas lights at $20 each per year. Boulevard lanterns will be used.

Passaic, N. J.—A bill will be introduced at the next session, at the solicitation of the Mayor and City Council of this city, asking that cities of the second class be given the right to supply gas for their own citizens.

St. Joseph, Mo.—The contract for installing a 520-h. p. Corliss engine in the new electric lighting plant was awarded to the Minneapolis Steel and Machinery Company of Minneapolis for $2,987. The Kansas City Engineering Company was awarded the contract for installing the new boilers for $5,902, and T. C. Augustine of this city the contract for constructing and erecting the smoke stack for $3,225.

West Bay City, Mich.—The Bay City Gas Company has made a proposition to this city offering to furnish gas for all purposes at $1.10 per thousand cu. ft. When the consumption reaches 150,000,000 cu. ft. per annum the rate is fixed at $1.05, and when it reaches 300,000,000 cu. ft. per annum the consumer is entitled to a discount of 1 per cent upon payment on or before the 16th day of the month for which the bill is rendered.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

St. Louis, Mo.—An ordinance has been introduced providing for the erection of three incinerating plants.

Ft. Wayne, Ind.—The garbage contract for the next year was awarded, Dec. 19, to Henry Schele, for $4,295.

Washington, D. C.—Bids are asked until Jan. 6 for furnishing supplies, including garbage cans. Isthmian Canal Com'n.

Ft. Sam Houston, Tex.—Sealed bids are asked until Jan. 5 for constructing and erecting a garbage crematory. L. J. Fleming, Const. Q. M.

Muncie, Ind.—The contract for a new garbage furnace has been awarded to the Decarie Incinerator Co. of Minneapolis, Minn., for $17,000.

Harrisburg, Pa.—Specifications were submitted, Dec. 19, for sweeping, cleaning, etc., the paved streets of this city for a period of 1, 3 or 5 years.

Baltimore, Md.—The contract for the additional garbage contract was awarded, Dec. 14, to the Baltimore Sanitary Contracting Co. for $51,000 for the next year, and $3,000 per year additional thereafter.

Indianapolis, Ind.—The Board of Public Works awarded contracts, Dec. 28, to Harmon & Hall of Troy, O., for 25 dumping wagons at $200 each. The wagons have a capacity of 5 cu. ft., and in dumping the bottom separates into two parts, which drop from hinges on either side of the bed. These wagons are a part of the equipment to be used in the city's new street sweeping department, which will be established Jan. 1. Other bids submitted were as follows: Watson Wagon Co., Canastota, N. Y., $304; Studebaker Bros. Mfg. Co., $161,70; National Drill Mfg. C., $169; Austin-Western Co., Chicago, $137; Haywood Wagon Co., Baldwinsville, N. Y., $159. Contracts were awarded Dec. 7 for other equipment for the department as follows: Eleven street sweeping machines, Marion County Const. Co., $150 each; 4 sprinkling wagons, same company, $175 each.

PARKS.

Youngstown, O.—A park is proposed in the East End.

Hoboken, N. J.—Council has purchased property to increase the area of the Elysian Park. Plans have been made for additional parks.

Jersey City, N. J.—Chas. N. Lowrie and Daniel W. Langton of New York City have been appointed landscape architects and will have charge of the construction of a public park on the West Side. Walter G. Muirhead, secy. Hudson Co. Park Comrs.

TOO LATE FOR CLASSIFICATION

Victoria, Tex.—City Council has ordered a survey made for constructing a sewerage and water works system.

Salt Lake City, Utah—Plans have been adopted for extending the sewerage system at a cost of about $1,000,000.

Monticello, Ind.—Bids are asked until Jan. 10 for building a sewer. John M. Miller, chmn bd. town trustees.

Bloomfield, Ind.—Bids are asked until Jan. 12 for constructing gravel roads in Beech and Wright townships. Bd. co. comrs.

Pine Bluff, Ark. — The contract for building a sewer in District No. 11 was awarded, Dec. 22, to Herman C. Gass of Belleville, Ill., for $13,494.18.

Hoboken, N. J.—The contract for paving Summit-ave., from Malone to Angelinque-sts., W. Hoboken, was awarded Dec. 21 to William Nolan for $6,984.76.

Tarboro, N. C.—Special—John S. Weddell, treasurer water and light department, says this city is considering the extension and enlarging of the present water works and sewerage systems, and that the question of street paving is also receiving attention.